FENCING TERMINALS AT BRIDGE ENDS (ROADWAY)

ELEVATION

FENCING TERMINALS AT BRIDGE ENDS (STREAM CROSSING)

ELEVATION

FENCING TERMINALS AT BRIDGE ENDS (ROADWAY)

ELEVATION

FENCING TERMINALS AT BOX CULVERTS

PLAN

(For Heights Of Headwalls Greater Than 4')

FENCING DETAIL AT CULVERT

(For Heights Of Headwalls 4' Or Less.)

Note: When height of headwall is 4' or less, the fence shall not be tied to the headwall, but shall span the lateral ditch.

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14' Max.
FENCING TERMINALS AT RURAL INTERCHANGES

NOTE: LA R/W along the crossroad will extend a minimum 200' beyond the end of the acceleration or deceleration ramp. In the absence of a ramp, the radius point of the ramp return will be used with the above criteria.

For interchange quadrants having no ramp the LA R/W will extend along the crossroad to a point opposite the limit of LA R/W established by the ramp taper or radius point as noted above.

APPLIES TO BRIDGE OVER CROSSROAD AND CROSSROAD OVER FREEWAY (BRIDGE OVER CROSSROAD SHOWN)

FENCING TERMINALS AT URBAN INTERCHANGES

Note A - The indicated distance shall be sufficient to provide satisfactory sight distance for the traffic from the ramp.

Note B - The indicated distance shall be identical to the above noted dimension, if practical.

FENCING TERMINALS AT RETAINING WALLS

6' Where Footing Permits

Terminates Fence Where Wall Height Approximately Equals Fence Height.

End LA R/W Line & Fence

End LA R/W Line & Fence See Note Above

6' Where Footing Permits

End LA R/W Line & Fence

L A R/W Line

End LA R/W Line & Fence See Note Above

FENCE LOCATION

FY 2016-17

DESIGN STANDARDS

REVISION

07/01/05

INDEX No.

800

SHEET No.

2 of 2
GENERAL NOTES

1. This fence to be provided generally in rural areas. For supplemental information see Section 550 of the FDOT Specifications.

2. Fabric shall be woven wire, either galvanized steel, meeting the requirements of ASTM A120, No. 9 Grade 60; Design Number 1047-8-9, with Class 2 zinc coating; No. 12½ Grade 175; Design Number 1047-12-12½, with a 10½ gage top and bottom wire and with Class 3 zinc coating; or aluminum coated steel, meeting the requirement of ASTM A526, No. 9 Farm, Design Number 1047-6-6, with a minimum coating weight of 0.60 oz./ft.². For additional information see payment note below.

3. Fence shall be installed with wire side to private property except on horizontal curves greater than 3°. On such curves, the fence shall be installed as to pull against all posts.

4. Posts may be either timber, steel, recycled plastic or concrete. Unless a specific post material is called for in the plans, the Contractor may elect to use either a single material or a combination of timber, steel, recycled plastic or concrete materials. One post of one material may be used with corner, pull and end post assemblies of a different material. Line posts of only one optional material and pull posts of only one optional material will be permitted between corner and end post assemblies. Within individual corner and end post assemblies only one optional material will be permitted.

5. Timber posts shall meet the material requirements of Specification Section 954. Timber line posts are to be minimum 4" diameter. Timber corner, pull, approach and end posts are to be a minimum 3½" diameter. Timber braces are to be minimum 1½" diameter.
   (A) Staples for line posts to be ½" minimum length, for approach, corner and pull posts ½" minimum length. At approach, corner and pull posts, staple every line wire. At line posts, staple every line wire in half and alternate line wires on bottom half. Staples shall be driven diagonally across the line wire with the points in separate grains.
   (B) Connections between timber posts and braces to be provided by dowels as shown in fastener details.
   (C) Wire to be wrapped and tied, as shown in the splice details, at the following locations:
      (i) At end posts, (ii) Corner post, including the assemblies at vertical breaks of 1½' or more and
      (iii) Pull posts where the wire is not spliced and pulled through the assembly, see General Note 18.

6. Steel posts and braces shall be standard steel posts, galvanized at the rate of 2 oz./ft.², together with necessary hardware and wire clamps and meeting the following requirements:
   (A) Line posts: 8' long, 1.13 lbs./ft.; roll formed stud; anchor plate attached (23 in.²).
   (B) Approach posts: 2½'x2½'x½' 4½ ft. long; fabricated for attaching brace; with necessary hardware, clamps, etc.
   (C) Pull, end and corner posts: 2½'x2½'x½' 4½ ft. long; fabricated for attaching brace; with necessary hardware, clamps, etc.
   (D) Braces: 2½'x2½'x½' angles, with necessary hardware and fabricated for attaching to post.
   (E) Pull, corner, approach and end posts are to be set in concrete as per detail. Also see General Note 15.

7. Recycled plastic posts shall meet the following material requirements: line posts shall have a minimum section of 4½"x4½"x½" square. Plastics shall not be used as corner, pull, end or approach posts unless such use is specifically detailed in the plans. The straightness of the posts shall comply with 954-5 for timber post. The straightness of the posts shall also be in accordance with the requirements of the latest edition of the Southern Pine Inspection Bureau’s Standard Grading Rules for Southern Pine Lumber For No. 25R Stress Rated Grade Timber. Plastic posts can be set by either digging and tamp hard or by driving into drill holes. Staples for fabric and barbed wire connection to plastic line posts shall be the same size, count and location as that for timber posts.

8. The Contractor, at his option, may use any suitable precast or prestressed concrete posts; however, approval by the Engineer of posts not shown in this index, will be required prior to construction of the Fence. Precast posts shall be Class 1 concrete. Prestressed posts shall be Class 2 concrete. Lengths of concrete post to be as indicated for timber posts.

9. Aluminum posts, braces and accessory framing hardware shall not be used unless the plans specifically detail their application or the Engineer specifically approves their incorporation in fence construction or repair. Aluminum framed gates are permitted as described in General Note 19.

10. The woven wire shall be attached to steel and concrete posts by a minimum of four tie wires. The single wire ties shall be applied to the top, bottom and two intermittent line wires. The ends of each tie wire shall have a minimum of two tight turns, around the line wire. Tie wires shall be steel wire not less than 0.120" diameter, zinc coating Class 3, soft temper, in accordance with ASTM A463.

11. Steel Barbed Wire may be either of the following types:
   Type B: This type shall conform to the requirements of ASTM A122, with two strands of 12½ gauge wire; four-point barbs, wire side 14 gauge, twisted around both line wires and Class 3 coatings.
   Design No. 12½-6-14R.
   Type II. This type same as Type I except that the two strand wires are twisted in alternating directions between consecutive barbs.
   Type II B: This type shall conform to the requirements of ASTM A122, with two strands of 15½ gauge high tensile wire; four-point barbs, wire size 16½ gage twisted around both line wires; and Class 3 coatings.
   Design No. 15½-6-16R.
   Aluminum Barbed Wire shall be fabricated of two strands of 0.110-inch wire with 0.08-inch diameter four-point barbs spaced at approximately 3½" intervals, and at a maximum spacing of 6". The wire for the strands and for the barbs shall be of ASTM A121, Alloy 6063-T58 or equal.

12. The woven wire shall be stretched only until one-half the tension curl has been pulled out of the line wires.

13. Posts to be set by driving or digging. If by digging, the posts shall be set at the center of the hole and the soil tamped securely on all sides.

14. Longer posts than those indicated above may be required by the plans or for deeper installations.

15. Concrete bases for angular steel posts (pull, corner, end and approach) shall be Class NS as specified in Section 647. Materials for Class NS concrete may be proportioned by volume or by weight.

16. Pull post assemblies shall be installed at approximately 330' centers except that this maximum interval may be reduced by the Engineer on curvatures where the radius is less than 3½'.

17. Corner post assemblies are to be installed at all horizontal and vertical breaks in fence of 15° or more.

18. A maximum length of 1320' of wire may be installed as a unit. For pulls through a pull post assembly the fabric shall be spliced by crimping sleeves only. Pulls through a corner post assembly will not be permitted.

19. Unless otherwise called for in the plans gates shall be commercially available metal swing gates assembled and installed in accordance with the manufacturer’s specifications as approved by the Engineer. Chain link swing gates in accordance with Index No. 803 may be substituted for metal swing gates as approved by the Engineer. Gate size is full opening width whether single leaf or double leaves. Payment for gates shall include the gate, single or double, all necessary hardware for installation and any additional length and/or size for posts at the opening. Gates shall be paid for under the contract unit price for Fence Gates, EA.

20. For construction purposes, assemblies are defined as follows: End post assemblies shall consist of:
   One end post, one approach post, two braces, four diagonal tension wires and all necessary fittings and hardware.
   Pull post assemblies shall consist of:
   One pull post, two braces, four diagonal tension wires and necessary fittings and hardware.
   Corner post assemblies shall consist of:
   One corner post, two approach posts, four braces, eight diagonal tension wires and all necessary fittings and hardware.

21. All posts, braces, tension wires, fabric, tie wires, Class NS concrete, and all miscellaneous fittings and hardware to be included in the cost for Fencing, LF. Fencing shall be inclusive of the lengths of pull, end and corner post assemblies, but exclusive of gate widths.
This index details fencing that is constructed with farm fabric 4610 (47" nominal) in height and with specific ground-clearance and specific barbed wire spacings. For fencing of different height or installation details, the fence shall be fully detailed in the Contract plans.
**FASTENER FOR CONCRETE POST AND BRACES**

- No. 7 Galv. Dowel, Metal Strap 1½" Wide
- ⅛" Carriage Bolt

**FASTENER FOR TIMBER POST AND BRACE**

- ⅝" x 9" Galv. Dowel
- ⅜" x 4" Galv. Dowel

**PRECAST POST**

- No. 3 Bars (4 Req'd.)
- ½" Chamfer Or ⅛" Rad., All Edges

**PRECAST BRACE**

- No. 3 Bars (2 Req'd.)
- ½" Chamfer Or ⅛" Rad., All Edges

**ALTERNATE CONCRETE POSTS AND BRACES**

**CORNER POSTS**

- Wire A
- Wire B
- Wire C

**END AND PULL POSTS**

- Corner
- Wire A
- Splice
- Wire B

Each horizontal wire to be wrapped around corner, end and pull posts and tied to same wire. See General Notes 5 and 17. Timber post illustrated. These methods also apply to steel and concrete post illustrations.

**SPLICES**
GENERAL NOTES

1. This fence to be used generally in urban areas.

2. For supplemental information refer to Section 550 of FDOT Standard Specifications.

3. Chain link fabric, post, truss rods, tension wires, tie wires, stretcher bars, gates and all miscellaneous fittings and hardware shall meet the requirements of AASHTO and ASTM signify current reference.

4. Fence Component Options:

A. Line post options:
   1. Galvanized steel pipe, Schedule 40 - 1½" nominal dia. zinc galvanized at the rate of 1.8 oz./ft²: ASTM A53 Table 2, Grade A or B, ASTM F1083, and AASHTO M111.
   2. Aluminum coated steel pipe; ASTM A53 steel, X 2 Tables Schedule 40, 1½" nominal dia., 1.660" OD; coated at the rate 0.40 oz./ft²: AASHTO M111.
   3. Aluminum alloy pipe - 2" nominal dia., ASTM B241 or B221, Alloy 6063, T6.
   4. Steel H-Beam - 1½" x 1½"": Zinc Galv. 1.8 oz./ft²: AASHTO M111 and Detail.
   5. Steel alloy H-Beam - 1½" x 1½": Zinc Galv. 1.8 oz./ft²: AASHTO M111 and Detail.
   6. Galvanized steel pipe, Schedule 40- 1½" nominal dia. zinc galvanized at the rate of 1.8 oz./ft²: ASTM A53 Table 2, Grade A or B, ASTM F1083, and AASHTO M111.
   7. Galvanized steel pipe, Schedule 40- 1½" nominal dia. zinc galvanized at the rate of 1.8 oz./ft²: ASTM A53 Table 2, Grade A or B, ASTM F1083, and AASHTO M111.
   8. Galvanized steel pipe, Schedule 40- 1½" nominal dia. zinc galvanized at the rate of 1.8 oz./ft²: ASTM A53 Table 2, Grade A or B, ASTM F1083, and AASHTO M111.

B. Corner, end, and pull post options:
   1. Galvanized steel pipe, Schedule 40 - 2" nominal dia. zinc galvanized at the rate of 1.8 oz./ft²: ASTM A53 Table 4 A, ASTM F1083, and AASHTO M111.
   2. Aluminum coated steel pipe, ASTM A53 steel, 2 Tension, Schedule 40, 2 nominal dia., 2.375" OD; coated at the rate 0.40 oz./ft²: AASHTO M111.
   3. Aluminum alloy pipe - 2" nominal dia.: ASTM B241 or B221, Alloy 6063, T6.
   4. Resistance welded steel pipe, 50,000 psi min. yield strength ASTM A569/A569M, A653/A653M or equivalent stock of same or AAGA/AAMM base material: ASTM F1043, Group 3 (Alternative Design: fence industry 1½" x 1½", 1.800" OD, 0.120" minimum wall thick.

C. Rail options:
   1. Galvanized steel pipe, Schedule 40 - 1½" nominal dia. zinc galvanized at the rate of 1.8 oz./ft²: ASTM A53 Table 2, ASTM F1083, and AASHTO M111.
   2. Aluminum coated steel pipe, ASTM A53 steel, X 2 Tables Schedule 40, 1½" nominal dia., 1.660" OD; coated at the rate 0.40 oz./ft²: AASHTO M111.
   3. Aluminum alloy pipe: 1½" nominal dia.: ASTM B241 or B221, Alloy 6063, T6.
   4. Resistance welded steel pipe, 50,000 psi min. yield strength ASTM A569/A569M, A653/A653M or equivalent stock of same or AAGA/AAMM base material: ASTM F1043, Group 4 (Alternative Design: fence industry 1½" x 1½", 1.800" OD, 0.120" minimum wall thick.
   5. Resistance welded steel pipe, 50,000 psi min. yield strength ASTM A569/A569M, A653/A653M or equivalent stock of same or AAGA/AAMM base material: ASTM F1043, Group 4 (Alternative Design: fence industry 1½" x 1½", 1.800" OD, 0.120" minimum wall thick.
   6. Galvanized steel pipe, Schedule 40- 1½" nominal dia. zinc galvanized at the rate of 1.8 oz./ft²: ASTM A53 Table 2, Grade A or B, ASTM F1083, and AASHTO M111.
   7. Galvanized steel pipe, Schedule 40- 1½" nominal dia. zinc galvanized at the rate of 1.8 oz./ft²: ASTM A53 Table 2, Grade A or B, ASTM F1083, and AASHTO M111.
   8. Galvanized steel pipe, Schedule 40- 1½" nominal dia. zinc galvanized at the rate of 1.8 oz./ft²: ASTM A53 Table 2, Grade A or B, ASTM F1083, and AASHTO M111.
   9. Galvanized steel pipe, Schedule 40- 1½" nominal dia. zinc galvanized at the rate of 1.8 oz./ft²: ASTM A53 Table 2, Grade A or B, ASTM F1083, and AASHTO M111.
   10. Galvanized steel pipe, Schedule 40- 1½" nominal dia. zinc galvanized at the rate of 1.8 oz./ft²: ASTM A53 Table 2, Grade A or B, ASTM F1083, and AASHTO M111.

D. Chain link fabric options (2) mesh with twisted and barbed selvage top and bottom for all options except as described in Note No. 10:

   1. Galvanized steel pipe, No. 7 gage coated at the rate 0.040 oz./ft²: AASHTO M181, Type I.
   2. AASHTO M181 Type II - Aluminum Coated Steel, No. 9 gage (coated wire diameter), coated at the rate 0.40 oz./ft²: AASHTO M181.
   3. AASHTO M181 Type IV - Polyvinyl Chloride (PVC) Coated Steel, No. 9 gauge (coated wire diameter), coated at the rate 0.40 oz./ft²: AASHTO M181.
   4. AASHTO M181 Type IV - Polyvinyl Chloride (PVC) Coated Steel, No. 9 gauge (coated wire diameter), coated at the rate 0.40 oz./ft²: AASHTO M181.
   5. AASHTO M181 Type IV - Polyvinyl Chloride (PVC) Coated Steel, No. 9 gauge (coated wire diameter), coated at the rate 0.40 oz./ft²: AASHTO M181.
   6. AASHTO M181 Type IV - Polyvinyl Chloride (PVC) Coated Steel, No. 9 gauge (coated wire diameter), coated at the rate 0.40 oz./ft²: AASHTO M181.

E. Tie wire and hog ring options:
   1. Steel wire No. 7 gage zinc galvanized at the rate of 1.2 oz./ft²: AASHTO M181.
   2. Steel wire No. 7 gage zinc galvanized at the rate of 1.2 oz./ft²: AASHTO M181.
   3. Steel wire No. 7 gage coated at the rate of 0.04 oz./ft²: AASHTO M181.
   4. Steel wire No. 7 gage coated at the rate of 0.04 oz./ft²: AASHTO M181.
GENERAL NOTES CONTINUED

5. Unless a specific material is called for in the plans the Contractor may elect to use either a single type of material or a combination of material types from the component options listed in note 4. Combinations of optional materials are restricted as follows:
(a) Only one fabric optional material will be permitted between corner and/or end post assemblies.
(b) Only one line post optional material will be permitted between corner and/or end post assemblies.
(c) Pull post assemblies shall be optional materials identical to the line post optional material or the corner and end post assembly optional material; but, pull post assemblies shall be the same optional material between any set of corner and/or end post assemblies.

6. Concrete post bases shall be Class NS concrete as specified in Section 347 of the Standard Specifications or a packaged, dry material meeting the requirements of a concrete under ASTM C-387. Materials for Class NS concrete may be proportioned by volume and/or by weight.

7. Line post shall be 8'-6" long (Standard). Line post are to be set in concrete as described above or by the following methods:
(a) In accordance with special details and/or as specifically described in the contract plans and specifications.
(b) In accordance with ASTM F567 Subsections 5.4 through 5.10 as approved by the Engineer.
(c) Line post installed in accordance with Section 5.8 shall be 9'-6" long.
(d) Post mounted on concrete structure or solid rock shall be mounted in accordance with the base plate detail "Fence Mounting On Concrete Endwalls And Retaining Wall", Sheet 3; or, by embedment in accordance with ASTM F567 Subsection 5.5.

End, pull and corner post assemblies shall be in concrete as detailed above for all soil conditions other than solid rock. Post within assemblies that are located on concrete structures or solid rock shall be set by base place or by embedment as prescribed under (b) above for line post.

Line and assembly posts for 6' fence which must be lengthened due to variations in the normal ground clearance, shall be set an additional 3' in depth for each 3' of additional ground clearance.

8. Pull post shall be used at breaks in vertical grades of 15° or more, or at approximately 350' centers except that this maximum interval may be reduced by the Engineer on curves where the curve is greater than 3°.

9. Corner post are to be installed at all horizontal breaks in fence at 15° or more and as required at vertical breaks over 15° as determined by the Engineer.

10. When fence has an installed top of fabric height less than 6' knuckled top and bottom selvages shall be used unless the plans specifically identify locations for twisted selvage fabrics.

11. Unless sliding gates or special gates are called for in the plans, all gates shall be chain link swing gates meeting the material requirements described and as approved by the Engineer. Payment shall include the gates, single or double, all necessary hardware for installation and any additional length and/or size for posts at the opening. Gates shall be paid for under the contract unit price for Fence Gates, EA.

12. For construction purposes corner post assemblies shall consist of one corner post, two braces, two truss rods, and all necessary fittings and hardware as detailed. End post assemblies shall consist of one end post, one brace, one truss rod and all necessary fittings and hardware as detailed.

13. In areas where there are physical constraints outside the right-of-way which restricts the fence construction, the fabric may be installed on the inside of the posts.

<table>
<thead>
<tr>
<th>TYPE IV VINYL COATED FABRIC</th>
<th>AASHTO M181 Table 4 Redefined As Follows</th>
</tr>
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<tbody>
<tr>
<td>Specified Diameter of Metallic Coated Core Wire</td>
<td>Minimum Weight of Zinc Coating</td>
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<td>mm</td>
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<tr>
<td>lbs.</td>
<td>kg</td>
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<td>PVC Thickness Range</td>
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<td>in.</td>
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<td>3.77</td>
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DESIGN NOTE

This Index details fencing that is constructed with chain link fabric 6' (nominal) in height and with specific ground clearance. For fencing of different height or installation details, the fence shall be fully detailed in the Contract plans.
**FENCE POSITION AT LOCATIONS WITHOUT FRONTAGE ROADS**

(REFER TO DETAIL PLANS FOR FENCE POSITION AT LOCATIONS WITH FRONTAGE ROADS)

**NOTES**

Attachments to be used only when called for in the plans.

Attachments to extend in direction of restraint, unless otherwise called for in plans, direction of restraint will be as follows:

(a.) Outward on limited access right of way line.

(b.) Outward on controlled access right of way line.

(c.) Outward from utilities and hazardous facilities located within highway right of way.

(d.) Outward from lateral ditches, outfalls, retention basins, canals, borrow areas and similar support facilities.

(e.) Inward on pedestrian ways.

The cap-arm shall be designed to provide a drive fit over the top of posts and to exclude moisture in posts with tubular sections.

**BASE PLATE AND ANCHOR NOTES:**

1. Base plate identical for line, pull, end and corner posts and shall be considered an integral part of the respective posts for basis of payment.

2. Post to be plumbed by grout shim under base plate.

3. Anchors (Galvanized Steel):
   - 12" Cast In Place, 100° Embedment
     - Headed Bolts, U-Bolts or Cluster Plates.
     - Adhesive anchors, 6" Min. Embedment.
     - Adhesive anchors shall have an adhesive material system in accordance with Specification Sections 416 and 937; drilled holes shall be larger in diameter than the anchor bolt.

   Expansion Bolts Not Permitted.

**BARB WIRE ATTACHMENT**

1. Base plate identical for line, pull, and corner posts and shall be considered an integral part of respective posts for basis of payment.

2. Post to be plumbed by grout for base plate.

3. Anchors (Galvanized Steel):
   - 12" Cast In Place, 100° Embedment
     - Headed Bolts, U-Bolts or Cluster Plates.
     - Adhesive anchors, 6" Min. Embedment.
     - Adhesive anchors shall have an adhesive material system in accordance with Specification Sections 416 and 937; drilled holes shall be larger in diameter than the anchor bolt.

   Expansion Bolts Not Permitted.
**CANTILEVER SLIDE GATE TYPE B FENCE**

**TYPICAL FRAME - 24' Opening**

<table>
<thead>
<tr>
<th>Gate Opening</th>
<th>Gate Frame</th>
<th>Back Frame</th>
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</thead>
<tbody>
<tr>
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<td>12'-3&quot;</td>
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<td>16'</td>
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<td>20'-3&quot;</td>
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</tr>
<tr>
<td>24'</td>
<td>24'-3&quot;</td>
<td>12</td>
</tr>
</tbody>
</table>

**GENERAL NOTES**

1. Extruded, rolled or formed components that provide equal strength and stability may be used in lieu of the pipe components shown; and, internal rollers may be used in lieu of the external roller units shown.

Gate components shall meet or exceed the protective coatings specified on Index No. 802.

2. Steel gate frame shall be fabricated prior to galvanizing, except that truss rods may be galvanized at the time of the frame. Extruded, rolled or formed components that provide equal strength and stability may be used in lieu of the external roller units shown.

Gate components shall meet or exceed the requirements of Index No. 802 that are intolerant of welding (low burn back), and a protective coating applied to the weld and damaged pipe surfaces that is equivalent to the protective coating of the fabricate pipe stock.

3. Steel gate frame shall be fabricated prior to galvanizing, except that truss rods may be galvanized at the time of the frame. Extruded, rolled or formed components that provide equal strength and stability may be used in lieu of the external roller units shown.

Concrete for bases shall be other Class RS concrete as specified in Section 347 of the Standard Specifications or a packaged, dry material meeting the requirements of a concrete under ASTM C-381. Materials for Class RS concrete may be proportioned by volume and/or by weight.

4. All fabric shall be knuckled top and bottom selvages.

Concrete for bases shall be other Class RS concrete as specified in Section 347 of the Standard Specifications or a packaged, dry material meeting the requirements of a concrete under ASTM C-381. Materials for Class RS concrete may be proportioned by volume and/or by weight.

5. Cost of all gate components shall be included in the contract unit price for Sliding Fence Gate (Cantilever), EA.
**FENCING NOTES**

**FENCE INSTALLATION:**
Install posts plumb (within a tolerance of ± 1/2") Use shim plates as required to achieve plumb. The required quantity and thickness of shim plates will be determined in the field. Install chain link fence in accordance with ASTM F 567 as applicable.

**TRAFFIC RAILING DETAILS:**
See Superstructure Sheets for Traffic Railing Barrier details.

**CONCRETE PARAPET DETAILS:**
See Index No. 820 – Pedestrian/Bicycle Railing for Concrete Parapets details. Provide fencing in lieu of aluminum bullet railing as shown on Index No. 820.

**LIMITS OF FENCING:**
Limits of fencing are from begin of approach slab at Begin Bridge to end of approach slab at End Bridge, unless otherwise shown in the plans.

**PAYMENT:**
Payment will be made under Fencing, Type R. Payment includes posts, horizontal and expansion rails, brace rails, bands, rail ends, combination rail ends, boulevard clamps, chain link fabric, tension wire, ties, hog rings, tension bars, and bands, post and loop caps, pipe clamps, base plates, anchor rods, bolts, nuts, washers, shim plates, spacers, neoprene pads, miscellaneous fence fittings and hardware and all incidental materials and labor required to complete installation of the fence.

**CROSS REFERENCE:**
For Table of Fence Components, Table of Post Attachment Components, View A-A and Detail "A" see Sheet No. 2.
For Pull Post Assembly Detail for Traffic Railing Barriers see Sheet No. 3.
For Pull Post Assembly Detail for Concrete Parapets and Detail "B" see Sheet No. 4.

* Fencing shall not anchor to the top of Traffic Railings.
TABLE OF CHAIN LINK FENCE COMPONENTS

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>ASTM DESIGNATION</th>
<th>COMPONENT INFORMATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posts</td>
<td>F 1083</td>
<td>Galvanized Steel Pipe - 3&quot; NPS, Schedule 40 (3.300&quot; Outside Diameter, 0.210&quot; Wall Thickness)</td>
</tr>
<tr>
<td>Chain Link Fabric</td>
<td>A 392</td>
<td>Zinc Coated Steel - No. 9 gage (coated wire diameter), Class 2 Coating</td>
</tr>
<tr>
<td>Tie Wires</td>
<td>F 626</td>
<td>Zinc Coated Steel Wire - No. 9 gage</td>
</tr>
<tr>
<td>Brace Bands</td>
<td>F 626</td>
<td>No. 12 Gage (Min. thickness) x 3/16&quot; (Min. width) Steel Bands (Beveried or Heavy)</td>
</tr>
<tr>
<td>Tension Bars</td>
<td>F 626</td>
<td>1/2&quot; (Min. thickness) x 3/16&quot; (Min. width) x 5-10&quot; (Min. height) Steel Bars</td>
</tr>
<tr>
<td>Expansion Rails</td>
<td>F 1083</td>
<td>Galvanized Steel Pipe - 2&quot; NPS, Schedule 40 (2.875&quot; Outside Diameter, 0.203&quot; Wall Thickness)</td>
</tr>
<tr>
<td>Bolts</td>
<td>A 307</td>
<td>1/4&quot; x 4&quot; Hex Head Bolt for Expansion Rail Connections</td>
</tr>
<tr>
<td>Washers</td>
<td>F 436</td>
<td>Flat Washers for Expansion Rail Connections</td>
</tr>
<tr>
<td>Tension Wire</td>
<td>A 824 &amp; A 817</td>
<td>Type II (Zinc Coated Steel Wire) - No. 7 gage, Class 4 Coating</td>
</tr>
<tr>
<td>Hog Rings</td>
<td>F 626</td>
<td>Zinc Coated Steel Wire - No. 12 gage</td>
</tr>
<tr>
<td>Pipe Clamp Connection</td>
<td>A 709 Grade 36</td>
<td>galvanized Chord with welded flanges (with pressure joints)</td>
</tr>
<tr>
<td>Pipe Clamps</td>
<td>A 36, A 709 Grade 36</td>
<td>Fully threaded Headless Anchor Rods - 3/8&quot; Ø x 6&quot; (no spacer) or 3/8&quot; Ø x 7&quot; (with spacer)</td>
</tr>
<tr>
<td>Base Plates</td>
<td>F 1554 Grade 36</td>
<td>Hex Head Anchor Rods - 3/8&quot; Ø x 6&quot; (no spacer) or 3/8&quot; Ø x 7&quot; (with spacer)</td>
</tr>
<tr>
<td>Shim Plates</td>
<td>A 36, A 709 Grade 36, or B 209 Alloy 6061-T6 or B 221 Alloy 6063-T5</td>
<td>Plate thicknesses as required. Holes in shim plates will be 3/8&quot; Ø</td>
</tr>
<tr>
<td>Spacers</td>
<td>-</td>
<td>3/16&quot; Ø for all materials</td>
</tr>
<tr>
<td>Adhesive Anchor Rods</td>
<td>F 1554 Grade 36</td>
<td>Fully threaded Headless Anchor Rods - 3/8&quot; Ø x 6&quot; (no spacer) or 3/8&quot; Ø x 7&quot; (with spacer)</td>
</tr>
<tr>
<td>Adhesive Anchor Rods</td>
<td>C-1-P Anchor Rods</td>
<td>Hex Head Anchor Rods - 3/8&quot; Ø x 6&quot; (no spacer) or 3/8&quot; Ø x 7&quot; (with spacer)</td>
</tr>
<tr>
<td>Nuts</td>
<td>A 563</td>
<td>Hex Nuts for Pipe Clamp Connections to Posts</td>
</tr>
<tr>
<td>Washers</td>
<td>F 436</td>
<td>Flat Washers for Pipe Clamp and Base Plate Connections</td>
</tr>
<tr>
<td>Neoprene Pads</td>
<td>-</td>
<td>In accordance with Specification Section 932</td>
</tr>
</tbody>
</table>

TABLE OF POST ATTACHMENT COMPONENTS

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>ASTM DESIGNATION</th>
<th>COMPONENT INFORMATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipe Clamp Connections</td>
<td>A 36, A 709 Grade 36</td>
<td>galvanized Chord with welded flanges (with pressure joints)</td>
</tr>
<tr>
<td>Base Plates</td>
<td>F 1554 Grade 36</td>
<td>Hex Head Anchor Rods - 3/8&quot; Ø x 6&quot; (no spacer) or 3/8&quot; Ø x 7&quot; (with spacer)</td>
</tr>
<tr>
<td>Shim Plates</td>
<td>A 36, A 709 Grade 36, or B 209 Alloy 6061-T6 or B 221 Alloy 6063-T5</td>
<td>Plate thicknesses as required. Holes in shim plates will be 3/8&quot; Ø</td>
</tr>
<tr>
<td>Spacers</td>
<td>-</td>
<td>3/16&quot; Ø for all materials</td>
</tr>
<tr>
<td>Adhesive Anchor Rods</td>
<td>F 1554 Grade 36</td>
<td>Fully threaded Headless Anchor Rods - 3/8&quot; Ø x 6&quot; (no spacer) or 3/8&quot; Ø x 7&quot; (with spacer)</td>
</tr>
<tr>
<td>Adhesive Anchor Rods</td>
<td>C-1-P Anchor Rods</td>
<td>Hex Head Anchor Rods - 3/8&quot; Ø x 6&quot; (no spacer) or 3/8&quot; Ø x 7&quot; (with spacer)</td>
</tr>
<tr>
<td>Nuts</td>
<td>A 563</td>
<td>Hex Nuts for Pipe Clamp Connections to Posts</td>
</tr>
<tr>
<td>Washers</td>
<td>F 436</td>
<td>Flat Washers for Pipe Clamp and Base Plate Connections</td>
</tr>
<tr>
<td>Neoprene Pads</td>
<td>-</td>
<td>In accordance with Specification Section 932</td>
</tr>
</tbody>
</table>

POST ATTACHMENT NOTES

ANCHOR RODS, NUTS AND WASHERS:
- After the nuts have been tightened, distort the Anchor Rod threads to prevent removal of the nuts. Coat distorted threads and exposed trimmed ends of anchors with a galvanizing compound in accordance with Specification Section 962.

ADHESIVE-BONDED ANCHORS AND DOWELS:
- Adhesive Bonding Material Systems for Anchors and Dowels will comply with Specification Section 937 and be installed in accordance with Specification Section 416. Cutting of reinforcing steel is permitted for drilled hole installation.

WELDING:
- All welding will be in accordance with the American Welding Society Structural Welding Code (Steel) ANSI/AWS D1.1 (current edition). Weld metal will be L60XX or E70XX. Nondestructive testing of welds is not required.

CROSS REFERENCE:
- For location of View A-A and Detail "A" see Sheet No. 1.
1. For treatment at bridge ends, see Sheet No. 1.
2. The 3'-0" dimension shown is for expansion joint openings 9" or less. If the expansion joint opening exceeds 9", increase this dimension by the difference between the expansion joint opening and 9".
PULL POST ASSEMBLY DETAIL FOR CONCRETE PARAPETS

EXPANSION ASSEMBLY DETAIL
(Required only at expansion joint locations where total movement exceeds 6")

NOTES:
1. For treatment at bridge ends, see Sheet No. 1.
2. The 3'-0" dimension shown is for expansion joint openings 9" or less. If the expansion joint opening exceeds 9", increase this dimension by the difference between the expansion joint opening and 9".
3. This Dimension is the expansion joint opening plus 1/2". Expansion rails are required at expansion joint locations where the total movement exceeds 1", but is less than or equal to 6". Expansion rails are part of expansion assemblies when the total movement exceeds 6". Install expansion rails midway between the fence posts spanning the expansion joint.
4. Install nuts for expansion rails finger-tight. Nuts will fully engage bolts with a minimum of one bolt thread extending beyond the nuts. Distort the first thread on the outside of the nut to prevent loosening.

CROSS REFERENCE:
For location of Detail "B" see Sheet No. 1.

BRIDGE FENCING (VERTICAL)
FENCING NOTES

FENCE APPLICATION:
This bridge fence can only be used on sidewalk installations separated from traffic by a traffic railing.

FENCE INSTALLATION:
Install posts plumb (within a tolerance of ± 1/8”). Use shim plates as required to achieve plumb. The required quantity and thickness of shim plates will be determined in the field. Install chain link fence in accordance with ASTM F 567 as applicable.

CONCRETE PARAPET DETAILS:
See Index No. 820 – Pedestrian/Bicycle Bullet Railing for Concrete Parapet details. Provide fencing in lieu of aluminum bullet railing as shown on Index No. 820.

LIMITS OF FENCING:
Limits of fencing are from begin of approach slab at Begin Bridge to end of approach slab at End Bridge, unless otherwise shown in the plans.

PAYMENT:
Payment will be made under Fencing, Type R. Payment includes posts, horizontal and expansion rails, brace bands, rail ends, combination rail ends, boulevard clamps, chain link fabric, ties, tension bars and bands, post and loop caps, base plates, anchor rods, bolts, nuts, washers, shim plates, neoprene pads, miscellaneous fence fittings and hardware and all incidental materials and labor required to complete installation of the fence.

CROSS REFERENCE:
For Table of Fence Components and Pull Post Assembly Detail see Sheet No. 2 of 3.
For Table of Post Attachment Components and Detail “A” see Sheet No. 3 of 3.
Polyvinyl Chloride (PVC) Coated Steel - No. 9 gage Zinc Coated Wire (metallic-coated core wire diameter) ~ Specify the color of the polymer coating in the General Notes

Aluminum Coated Steel - No. 9 gage (coated wire diameter)

Zinc Coated Steel - No. 9 gage (coated wire diameter), Class 2 Coating

Flat Washers for Expansion Rail Connections

Hex Nuts for Expansion Rail Connections

Galvanized Steel Pipe - 3" NPS, Schedule 40 (3.500" Outside Diameter, 0.216" Wall Thickness)

F 1083

A 307

A 563

F 436

A 392

A 493

F 668

F 626

F 626

F 626

No. 14 Gage (Min. thickness) x \( \frac{3}{8} \) (Min. width) x Variable Height Steel Bands ~ Height = Post Length along Inside Post - 2" Max.

\[ \frac{1}{2} \text{"Ø x } \frac{1}{4} \text{" Hex Head Bolts for Expansion Rail Connections} \]

\[ \frac{1}{4} \text{"Ø x 1\" Hex Nut with Washer (See Note 2)} \]

Zinc Coated Steel Wire - No. 9 gage

Zinc Coated Steel ~ (includes post or loop caps, horizontal and brace rail ends, combination rail ends, boulevard clamps and all other miscellaneous fittings and hardware)

Concrete Parapet

Expansion Joint Opening

Tension Bands (5 required per Tension Bar - Space Evenly @ 1'-3" Maximum Centers) (Typ.)

Ties @ 2'-0" Centers (Typ.)

Chain Link Fabric

Pull Post Assembly (required at maximum intervals of 500'-0")

\[ \frac{1}{2} \text{"Ø x 1\" Hex Nut with Washer (See Note 2)} \]

Legend: NPS = Nominal Pipe Size

Notes:
1. This Dimension is the expansion joint opening plus \( \frac{1}{2} \). Expansion rails are required at expansion joint locations where the total movement exceeds 1", but is less than or equal to 6". Expansion rails are part of expansion assemblies when the total movement exceeds 6". Install expansion rails midway between the fence posts spanning the expansion joint.
2. Install nuts for expansion rails finger-tight. Nuts will fully engage bolts with a minimum of one bolt thread extending beyond the nuts. Distort the first thread on the outsiders of the nut to prevent loosening.
3. For treatment at bridge ends, see Sheet No. 1 of 3.
4. The 3'-0" dimension shown is for expansion joint openings 9" or less. If the expansion joint opening exceeds 9", increase this dimension by the difference between the expansion joint opening and 9".

<table>
<thead>
<tr>
<th>COMPONENT INFORMATION</th>
<th>ASTM DESIGNATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posts</td>
<td>F 1083 Galvanized Steel Pipe ~ 3½&quot; NPS, Schedule 40 (4.000&quot; Outside Diameter, 0.226&quot; Wall Thickness)</td>
</tr>
<tr>
<td>Horizontal Rails</td>
<td>F 1083 Galvanized Steel Pipe - 3&quot; NPS, Schedule 40 (3.500&quot; Outside Diameter, 0.216&quot; Wall Thickness)</td>
</tr>
<tr>
<td>Expansion Rails</td>
<td>F 1083 Galvanized Steel Pipe - 25½&quot; NPS, Schedule 40 (2.875&quot; Outside Diameter, 0.203&quot; Wall Thickness)</td>
</tr>
<tr>
<td>Bolts</td>
<td>A 307 ( \frac{1}{2} \times \frac{3}{16} ) Hex Head Bolts for Expansion Rail Connections</td>
</tr>
<tr>
<td>Nuts</td>
<td>A 563 Hex Nuts for Expansion Rail Connections</td>
</tr>
<tr>
<td>Washers</td>
<td>F 436 Flat Washers for Expansion Rail Connections</td>
</tr>
<tr>
<td>Chain Link Fabric</td>
<td>A 392 Zinc Coated Steel - No. 9 gage (coated wire diameter), Class 2 Coating</td>
</tr>
<tr>
<td></td>
<td>A 493 Aluminum Coated Steel - No. 9 gage (coated wire diameter)</td>
</tr>
<tr>
<td>Tie Wires</td>
<td>F 668 Polyvinyl Chloride (PVC) Coated Steel - No. 9 gage Zinc Coated Wire (metallic-coated core wire diameter) ~ Specify the color of the polymer coating in the General Notes</td>
</tr>
<tr>
<td>Brace Bands</td>
<td>F 626 No. 12 Gage (Min. thickness) x ( \frac{3}{8} ) (Min. width) Steel Bands (Beveled or Heavy)</td>
</tr>
<tr>
<td>Tension Bars</td>
<td>F 626 ( \frac{1}{2} \text{&quot;Ø (Min. thickness) x } \frac{3}{8} \text{&quot; (Min. width) x Variable Height Steel Bars - Height = Post Length along Inside Post - 2&quot; Max.}</td>
</tr>
<tr>
<td>Tension Bands</td>
<td>F 626 No. 14 Gage (Min. thickness) x ( \frac{3}{8} ) (width) Steel Bands</td>
</tr>
<tr>
<td>Miscellaneous Fence Components</td>
<td>F 626 Zinc Coated Steel ~ (includes post or loop caps, horizontal and brace rail ends, combination rail ends, boulevard clamps and all other miscellaneous fittings and hardware)</td>
</tr>
</tbody>
</table>
## Table of Post Attachment Components

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>ASTM Designation</th>
<th>Component Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base Plates</td>
<td>A 36 or A 709 Grade 36</td>
<td>( \frac{3}{8} )&quot; Steel ( \varnothing )</td>
</tr>
<tr>
<td>Shim Plates</td>
<td>A 36 or A 709 Grade 36 or B 209 Alloy 6061-T6 or B 221 Alloy 6063-T6</td>
<td>Plate thicknesses as required, Holes in shim plates will be ( \frac{3}{8} )&quot; ( \varnothing )</td>
</tr>
<tr>
<td>Adhesive Anchor Rods</td>
<td>F 1554 Grade 36</td>
<td>Fully threaded Headless Anchor Rods – ( \frac{3}{8} )&quot; ( \times ) 14 gauge</td>
</tr>
<tr>
<td>C-I-P Anchor Rods</td>
<td>F 1554 Grade 36</td>
<td>Hex Head Anchor Rods – ( \frac{3}{8} )&quot; ( \times ) 14 gauge</td>
</tr>
<tr>
<td>Nuts</td>
<td>A 563</td>
<td>Hex Nuts for Base Plate Connections</td>
</tr>
<tr>
<td>Washers</td>
<td>F 436</td>
<td>Flat Washers for Base Plate Connections</td>
</tr>
<tr>
<td>Neoprene Pads</td>
<td>-</td>
<td>In accordance with Specification Section 932</td>
</tr>
</tbody>
</table>

### Post Attachment Notes

**ANCHOR RODS, NUTS AND WASHERS:**
After the nuts have been tightened, distort the Anchor Rod threads to prevent removal of the nuts. Coat distorted threads and exposed trimmed ends of anchors with a galvanizing compound in accordance with Specification Section 562.

**COATINGS:**

**ADHESIVE-BONDED ANCHORS AND DOWELS:**
Adhesive Bonding Material Systems for Anchors and Dowels will comply with Specification Section 937 and be installed in accordance with Specification Section 416. Cutting of reinforcing steel is permitted for drilled hole installation.

**WELDING:**
All welding will be in accordance with the American Welding Society Structural Welding Code (Steel) ANSI/AWS D1.1 (current edition). Weld metal will be E60XX or E70XX. Nondestructive testing of welds is not required.

### Adhesive Anchor Rods

- **C-I-P Anchor Rods**
- **Hex Head Anchor Rods**
- **Flat Washers for Base Plate Connections**

### Neoprene Pads

- In accordance with Specification Section 932

### Diagrams

- **Detail "A"**
- **Base Plate Detail**

**Cross Reference:**
For location of Detail "A" see Sheet No. 1 of 3.

---

**Design Standards**

**Bridge Fencing (Curved Top)**

**FY 2016-17**

**Last Revision:** 07/01/15

**Index No.:** 811

**Sheet No.:** 3 of 3
**FENCE INSTALLATION:**

Install posts plumb (within a tolerance of ± 1\(\frac{1}{2}\)\). Use shim plates as required to achieve plumb. The required quantity and thickness of shim plates will be determined in the field. Install chain link fence in accordance with ASTM F 567 as applicable.

**TRAFFIC RAILING BARRIER DETAILS:**

See Superstructure Sheets for Traffic Railing Barrier details.

**CONCRETE PARAPET DETAILS:**

See Index No. 820 - Pedestrian/Bicycle Railing for Concrete Parapet details. Provide fencing in lieu of aluminum bullet railing as shown on Index No. 820.

**LIMITS OF FENCING:**

Limits of fencing are from begin of approach slab at Begin Bridge to end of approach slab at End Bridge, unless otherwise shown in the plans.

**PAYMENT:**

Payment will be made under Fencing, Type R. Payment includes posts, horizontal and expansion rails, brace bands, rail ends, combination rail ends, boulevard clamps, chain link fabric, tension wire, ties, hog rings, tension bars and bands, pipe clamps, base plates, anchor rods, bolts, nuts, washers, shim plates, spacers, neoprene pads, miscellaneous fence fittings and hardware and all incidental materials and labor required to complete installation of the fence.

**FENCING NOTES**

1. A Pull Post Assembly is required at maximum intervals of 500’-0". See Sheet No. 3 of 4.
2. Dimension is measured along Inside Face of Concrete Parapet.
3. Dimension shown is for 32" F-Shape Traffic Railing Barriers as shown in Index No. 420. Adjust as required for other Traffic Railing Barriers and sidewalk widths.
4. For sidewalk clear widths greater than 5'-0", increase the radius and height of the curved portion of the Hoop Post at the rate of 6" for every one foot increase in sidewalk width.

**CROSS REFERENCE:**

For Table of Fence Components and Table of Post Attachment Components see Sheet No. 2.
For Pull Post Assembly Detail, View A-A and Detail "A" see Sheet No. 3.
For Detail "B" and "E" see Sheet No. 4.

**ELEVATION AT INSIDE FACE OF CONCRETE PARAPET**

**NOTES:**

1. A Pull Post Assembly is required at maximum intervals of 500’-0". See Sheet No. 3 of 4.
2. Dimension is measured along Inside Face of Concrete Parapet.
3. Dimension shown is for 32" F-Shape Traffic Railing Barriers as shown in Index No. 420. Adjust as required for other Traffic Railing Barriers and sidewalk widths.
4. For sidewalk clear widths greater than 5'-0", increase the radius and height of the curved portion of the Hoop Post at the rate of 6" for every one foot increase in sidewalk width.
TABLE OF CHAIN LINK FENCE COMPONENTS

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<thead>
<tr>
<th>COMPONENT INFORMATION</th>
<th>ASTM DESIGNATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posts</td>
<td>F 1083</td>
</tr>
<tr>
<td>Galvanized Steel Pipe</td>
<td>3&quot; NPS, Schedule 40 (3.500&quot; Outside Diameter, 0.216&quot; Wall Thickness)</td>
</tr>
<tr>
<td>Horizontal Rails and Internal Sleeves</td>
<td>F 1083</td>
</tr>
<tr>
<td>Galvanized Steel Pipe</td>
<td>2½&quot; NPS, Schedule 40 (2.875&quot; Outside Diameter, 0.203&quot; Wall Thickness)</td>
</tr>
<tr>
<td>Expansion Rails</td>
<td>F 1083</td>
</tr>
<tr>
<td>Galvanized Steel Pipe</td>
<td>2&quot; NPS, Schedule 40 (2.375&quot; Outside Diameter, 0.154&quot; Wall Thickness)</td>
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<tr>
<td>Chain Link Fabric (2&quot; mesh with knuckled bottom selvages)</td>
<td>A 392</td>
</tr>
<tr>
<td>Zinc Coated Steel - No. 9 gage (coated wire diameter), Class 2 Coating</td>
<td></td>
</tr>
<tr>
<td>A 491</td>
<td></td>
</tr>
<tr>
<td>Aluminum Coated Steel - No. 9 gage (coated wire diameter)</td>
<td></td>
</tr>
<tr>
<td>F 668</td>
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<tr>
<td>Polyvinyl Chloride (PVC) Coated Steel - No. 9 gage Zinc Coated Wire (metallic-coated core wire diameter) - Specify the color of the polymer coating in the General Notes</td>
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<tr>
<td>A 624 &amp; A 817</td>
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<tr>
<td>Type II (Zinc Coated Steel Wire) - No. 7 gage, Class 4 Coating</td>
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</tr>
<tr>
<td>Type I (Aluminum Coated Steel Wire) - No. 7 gage</td>
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<tr>
<td>Tension Wire</td>
<td>F 626</td>
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<tr>
<td>Zinc Coated Steel Wire - No. 9 gage</td>
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<tr>
<td>Screw Nuts</td>
<td>A 276</td>
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<td>Zinc Coated Steel Screw Nuts</td>
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<tr>
<td>Spacers</td>
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<tr>
<td>Hot-dip galvanized Spacers</td>
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<tr>
<td>Cap Screws</td>
<td>A 392</td>
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<tr>
<td>Zinc plated Cap Screws</td>
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</tr>
<tr>
<td>Bolt Caps</td>
<td>A 626</td>
</tr>
<tr>
<td>Zinc plated Bolt Caps</td>
<td></td>
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<tr>
<td>Tension Bars</td>
<td>F 626</td>
</tr>
<tr>
<td>½&quot; (Min. thickness) x ½&quot; (Min. width) Variable Height Steel Bars - Height = Tangent or Hoop Length - Barrier or Parapet Height - 2&quot; max</td>
<td></td>
</tr>
<tr>
<td>Tension Bands</td>
<td>F 626</td>
</tr>
<tr>
<td>¼&quot; gage (Min. thickness) x ¾&quot; (Min. width) Steel Bands</td>
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<td>Miscellaneous Fence Components</td>
<td>F 626</td>
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<tr>
<td>Zinc Coated Steel - (includes horizontal rail ends, combination rail ends, boulevard clamps and all other miscellaneous fittings and hardware)</td>
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<tr>
<td>Bolts</td>
<td>A 307</td>
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<tr>
<td>½&quot; Ø x ¢4½ Hex Head Bolts for Internal Sleeve connections</td>
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<tr>
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<tr>
<td>Hex Nuts for Internal Sleeve and Expansion Rail connections</td>
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<tr>
<td>Washers</td>
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<td>Flat Washers for Internal Sleeve and Expansion Rail connections</td>
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TABLE OF POST ATTACHMENT COMPONENTS

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<th>COMPONENT INFORMATION</th>
<th>ASTM DESIGNATION</th>
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<tbody>
<tr>
<td>Pipe Clamps</td>
<td>A 36 or A 709 Grade 36</td>
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<tr>
<td>Base Plates</td>
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<td>Shim Plates</td>
<td>A 36 or A 709 Grade 36 or B 209 Alloy 6061-T6 or B 221 Alloy 6063-75</td>
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<td>Spacers</td>
<td>-</td>
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<tr>
<td>½&quot; Ø for all materials</td>
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<td>F 1554 Grade 36</td>
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<tr>
<td>Fully threaded Headless Anchor Rods - ½&quot; Ø x 6&quot; (no spacer) or ½&quot; Ø x 7½&quot; (with spacer)</td>
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<td>C-1-P Anchor Rods</td>
<td>F 1554 Grade 36</td>
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<td>Hex Head Anchor Rods - ½&quot; Ø x 6&quot; (no spacer) or ½&quot; Ø x 7½&quot; (with spacer)</td>
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<td>Adhesive Anchor Rods</td>
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<td>A 307</td>
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<td>½&quot; Ø x ¢4½ Hex Head Bolts for Pipe Clamp Connections to Posts</td>
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<tr>
<td>Nuts</td>
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<tr>
<td>Hex Nuts for Pipe Clamp and Base Plate Connections</td>
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<td>Washers</td>
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<tr>
<td>Flat Washers for Pipe Clamp and Base Plate Connections</td>
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<tr>
<td>Neoprene Pads</td>
<td>-</td>
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<tr>
<td>In accordance with Specification Section 932</td>
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POST ATTACHMENT NOTES

ANCHOR RODS, NUTS AND WASHERS:
- After the nuts have been tightened, distort the Anchor Rod threads to prevent removal of the nuts. Coat distorted threads and exposed trimmed ends of anchors with a galvanizing compound in accordance with Specification Section 562.
- CORRUGINES:
- ADHESIVE-BONDED ANCHORS AND DOWELS:
  - Adhesive Bonding Material Systems for Anchors and Dowels will comply with Specification Section 937 and be installed in accordance with Specification Section 416. Cutting of reinforcing steel is permitted for drilled hole installation.
- WELDING:
  - All welding will be in accordance with the American Welding Society Structural Welding Code (Steel) AWS D1.1 (current edition). Weld metal will be E60XX or E70XX. Nondestructive testing of welds is not required.
CROSS REFERENCE:
For location of View A-A and Detail "A" see Sheet No. 1 of 4.

NOTES:
1. For treatment at bridge ends, see Sheet 1.
2. The 3'-0" dimension shown is for expansion joint openings 9" or less. If the expansion joint opening exceeds 9", increase this dimension by the difference between the expansion joint opening and 9".

DETAIL "A"

PIPE CLAMP CONNECTION DETAIL
(Connection without spacer shown, Connection with spacer similar)

EXPANSION ASSEMBLY DETAIL
(Required only at expansion joint locations where total movement exceeds 6")

PULL POST ASSEMBLY DETAIL
(Traffic Railing Barrier Shown, Concrete Parapet Similar)
PIE CLAMP DETAIL

SPACER DETAIL
(Must be manufactured from an incompressible material (i.e., steel or aluminum))

BASE PLATE DETAIL

DIM. H (See Table Below)

SIDEWALK CROSS-SLOPE

<table>
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<th>SIEMES</th>
<th>DIM. H (See Note 1)</th>
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<td>2% Right</td>
<td>5'-3½&quot;</td>
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NOTES:
1. Values shown for Dim. H are for a 5'-0" clear sidewalk width. Adjust as required for clear sidewalk widths greater than 5'-0".
2. For clear sidewalk widths greater than 5'-0" increase radius and height by 6" for every one foot increase in sidewalk width.
3. Spacer plate thickness shown is for the 32" F-Shape Traffic Railing shown in Index No. 420. Adjust thickness as required for other Traffic Railings.

CROSS REFERENCE:
For location of Details "B" and "E" see Sheet No. 1.
**Conventional Reinforcing (Welded Wire Reinforcement)**

- **Coping (Typ.)**
  - Edge of Approach Slab (Coping)
  - Approach Slab
  - Inside face of Concrete Parapet
  - Deck Joint *

- **Intermediate Open Joints** shall be provided at locations coinciding with 1/2 Joint for the Pedestrian/Bicycle Railings. Open Parapet Joints at Deck Expansion Joint locations shall match the dimension of the Deck Joint. For treatment of Railings on skewed bridges see Index 420. Deck Joint at Begin Bridge or End Bridge shown. Deck Joint at Pier or Intermediate Pier similar.

- **V-Groove in both faces and top of Concrete Parapet** (Equally spaced between open joints)

**Plan**

(Rails, Posts & Reinforcing Steel not shown for clarity)

**Intermediate Joint Seal Note:**
1. At Intermediate Open Joints, seal the lower 10" portion of the open joint with Pre-cured Silicone Sealant in accordance with Section 932 of the Specifications.
2. Apply sealant prior to any Class V finish coating and remove all curing compound coating and remove all curing compound to application of bonding agent.
3. The cost of the Pre-cured Silicone Sealant shall be included in the Contract Unit Price for the Concrete Parapet.

**Elevation of Inside Face of Railing**

(Restraining Steel not shown for clarity)

**Estimated Concrete Parapet Quantities**

<table>
<thead>
<tr>
<th>Item</th>
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<th>Quantity</th>
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</thead>
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<tr>
<td>Reinforcing Steel</td>
<td>LB/FT</td>
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(The above quantities are based on a deck with a 2% cross slope)

**Reinforcing Steel Notes:**
1. All bar dimensions in the bending diagrams are out to out.
2. The reinforcement for the parapet on a retaining wall shall be the same as detailed above for a 10" deck.
3. All reinforcing steel at the open joints shall have a 2" minimum cover.
4. Bars 4S may be continuous or spliced at the construction joints. Bar splices for Bars 4S shall be a minimum of 1'-0".
5. At the option of the Contractor Welded Wire Reinforcement (WWR) may be used in lieu of all Bars 4P and 4W. WWR must consist of deformed wire meeting the requirements of Specification Section 931.

**Pedestrian/Bicycle Railings Notes:**
**Concrete Parapet:** Concrete parapet shall be placed vertical and top surface shall be level transversely.

**Rail and Post Details:** For Rail, Post, Rail Splice/Expansion Assembly Fabrication and installation details see Index 822. 
**Bridge Fencing:** For Bridge Fencing see Index 810, 811 or 812 in lieu of Posts and Rails on Index 822.
**Payment:** Concrete parapet shall be paid for under the contract unit price for 27" Concrete Parapet (Pedestrian/Bicycle), LF, and Rails shall be paid as under Aluminum Bullet Railings, LF.

**Plan**

(Bridges, Intersecting Sidewalks, Plan View)

**Intermediate Open Joint:**

**Pre-Cured Silicone Sealant (4" wide)**

**Detail A - Section at Intermediate Open Joint**

**Estimation for Concrete Parapet (Pedestrian/Bicycle) LF, and Rails:**

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Unit</th>
<th>Quantity</th>
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</thead>
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<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td>LB/FT</td>
<td>6.29</td>
</tr>
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</table>

**Adjacent Units:**

**Concrete Parapet:** Concrete parapet shall be placed vertical and top surface shall be level transversely.

**Rail and Post Details:** For Rail, Post, Rail Splice/Expansion Assembly Fabrication and installation details see Index 822. 
**Bridge Fencing:** For Bridge Fencing see Index 810, 811 or 812 in lieu of Posts and Rails on Index 822.
**Payment:** Concrete parapet shall be paid for under the contract unit price for 27" Concrete Parapet (Pedestrian/Bicycle), LF, and Rails shall be paid as under Aluminum Bullet Railings, LF.
ELEVATION OF INSIDE FACE OF TRAFFIC RAILING WITH PEDESTRIAN/BICYCLE BULLET RAILING

NOTES:
1. Where Bullet Railing continues on retaining wall mounted Traffic Railings or other Traffic Railings, the Tapered End Transition shall be located at the terminus of the Bullet Railing.

CROSS REFERENCES:
1. Work in conjunction with Index 822.
2. For Traffic Railing Details, Reinforcement and Notes see Index 420.

SECTION A-A
TYPICAL SECTION THRU BRIDGE DECK
(APPROACH SLAB SIMILAR)
SECTION C-C (RAILS NOT SHOWN)
POST "D" DETAILS FOR SPECIAL HEIGHT BICYCLE RAILING ON CONCRETE PARAPET (INDEX 820)

SECTION D-D (RAILS NOT SHOWN)
ELEVATION OF POST "D"
POST "B" DETAILS FOR SPECIAL HEIGHT BICYCLE RAILING ON TRAFFIC RAILINGS (INDEX 423 AND 821) AND FOR PEDESTRIAN/BICYCLE RAILING ON CONCRETE PARAPETS (INDEX 820)

SECTION F-F
BASE PLATE DETAIL
RAIL TO POST CONNECTION DETAIL
NOTE: After nuts have been tightened, the bolt threads shall be deformed to prevent removal of nuts. Tack welding of nuts to anchor bolts, to prevent theft, is permitted. Coat deformed or tack welded threads with a galvanizing compound in accordance with Specification Section 562.

CROSS REFERENCES:
For Post "B" and Post "D" spacing see Index 820.
For Post "B" & Post "C" spacing see Index 423 or 821.
For Rail Details see Sheet 2.
For Railing Notes and Tapered End Transition Details see Sheet 3.

NOTE: After nuts have been tightened, the bolt threads shall be deformed to prevent removal of nuts. Tack welding of nuts to anchor bolts, to prevent theft, is permitted. Coat deformed or tack welded threads with a galvanizing compound in accordance with Specification Section 562.
**RAIL INSTALLATION:** Set Rail Posts normal to Profile Grade longitudinally and vertically transversely. Post spacings shall consist of rail bar or parapet obstacles such as armor expansion plates etc. shall be adjusted to clear obstacles by 3" without exceeding maximum post spacing. Post shall be uniformly spaced with reasonable consistency. Set Posts on 1/2" thick resilient or neoprene pads in accordance with Specification Section 932. The pad dimension shall be the same as the post base plate. Provide rail expansion assembly in panels between posts on either side of Bridge Expansion Joints. Rail expansion assembly is similar to the rail splice assembly with increased space at assembly to allow for movement equal to 1.5 times the bridge joint opening or 1" greater than the expected joint movement. Take care to ensure rails are set with the proper openings. Remove any burrs or sharp edges on rails and posts to prevent injury.

**RAIL CLAMP BARS:** Aluminum; ASTM B221, alloy 6061-T6, or alloy 6351-T5. Stop Pins shall be press-fit Aluminum or Stainless Steel pins or tubes, unless otherwise approved by the Engineer.

**ANCHOR BOLTS:** Anchor bolts shall be in accordance with ASTM A307 or ASTM F1554, Grade 36. Anchor Bolts, Nuts, and Washers shall be hot dip galvanized in accordance with Specification Section 962.

**WELDING:** Welding of aluminum components shall be in accordance with ANSI and AWS D1.2 "Structures Welding Code – Aluminum".

**POST ASSEMBLY:** Fabricated wrought aluminum; Post - ASTM B221, alloy 6061-T6, or alloy 6351-T5; Base Plate - ASTM B909, alloy 6061-T6.

**RAIL SPICE/EXPANSION ASSEMBLIES:** Aluminum; ASTM B221, alloy 6061-T6, or alloy 6351-T5. Stop Pins shall be press-fit Aluminum or Stainless Steel pins or tubes, unless otherwise approved by the Engineer.

**RAIL CLAMP BARS:** Aluminum; ASTM B221, alloy 6061-T6, or alloy 6351-T5. Stop Pins shall be press-fit Aluminum or Stainless Steel pins or tubes, unless otherwise approved by the Engineer.

**INDEX NO.**

**SHEET NO.** 3 of 3
**42" CONCRETE PEDESTRIAN/BICYCLE RAILING**

**DESCRIPTION:**

**REVISION NO.**

**SHEET NO.**

**INDEX NO.**

**DESCRIPTION:**

42" CONCRETE PEDESTRIAN/BICYCLE RAILING

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(The above quantities are based on a deck with a 2% cross slope)

**PLAN**

(Reinforcing Steel not shown for clarity)

**ELEVATION OF INSIDE FACE OF RAILING**

(Reinforcing Steel not shown for clarity)

**ALTERNATE REINFORCING (WELDED WIRE REINF.) DETAILS**

**NOTE:** Place wire panels to ensure vertical wire is within 4' of open joints.

**WELDED WIRE REINFORCEMENT (WWR)**

(2 Pieces Req'd.)

**BILL OF REINFORCING STEEL**

**BILL OF REINFORCING STEEL BENDING DIAGRAMS**

**NOTE:** For treatment of Railings on skewed bridges see Index No. 420. Deck Joint at Begin Bridge or End Bridge shown. Deck Joint at Pier or Intermediate Bent similar.

**SECTION A-A**

(Typical C-I-P Section Thru Bridge Deck Shown, Section Thru Approach Slab Similar)

**RAILING NOTES:**

1. Railing shall be placed vertical and top surface shall be level transversely.

**INTERMEDIATE JOINT SEAL NOTES:**

1. At Intermediate Open Joints, seal the lower 6" portion of the open joint with Pre-cured Silicone Sealant in accordance with Specification Section 932.

2. Apply sealant prior to any Class 5 Finish Coating and remove all curing compound and loose material from the surface prior to application of bonding agent.

3. The cost of the Pre-cured Silicone Sealant shall be included in the Contract Unit Price for the Railing.

**REINFORCING STEEL NOTES:**

1. All bar dimensions in the bending diagrams are out to out.

2. The reinforcement for the railing on a retaining wall shall be the same as detailed above for an 8" deck.

3. All reinforcing steel at the open joints shall have a 2" minimum cover.

4. Bar splices for Bars 4S shall be a minimum of 1'-4".

5. At the option of the Contractor Welded Wire Reinforcement (WWR) may be used in lieu of all Bars 3R and 4S. Welded Wire Reinforcement shall conform to Specification Section 931.

**REINFORCING STEEL**

(2 Pieces Req'd.)

**BAR 3R**

**BAR 4S**

**CONVENTIONAL REINFORCING STEEL BENDING DIAGRAMS**

**NOTE:** For treatment of Railings on skewed bridges see Index No. 420. Deck Joint at Begin Bridge or End Bridge shown. Deck Joint at Pier or Intermediate Bent similar.

**DETAIL "A" - SECTION AT INTERMEDIATE OPEN JOINT**

**ESTIMATED CONCRETE RAILING QUANTITIES**

(These quantities are based on a deck with a 2% cross slope)
ALTERNATE REINFORCING (WELDED WIRE REINF.) DETAILS

NOTE: Place wire panels to minimize the end overhang. End overhangs greater than 4\(\frac{3}{4}\) are not permitted.

1. All bar dimensions in the bending diagrams are out to out.
2. The reinforcement for the curb on a retaining wall shall be the same as detailed for an 8" deck.
3. All reinforcing steel at the open joints shall have a 2" minimum cover.
4. Bars 4S may be continuous or spliced at the construction joints. Bar splices for Bars 45 shall be a minimum of 1'-9".
5. At the option of the Contractor Welded Wire Reinforcement (WWR) may be used in lieu of all Bars 4P and 45. WWR must consist of Defomed wire meeting the requirements of Specification Section 931.

WELDED WIRE REINFORCEMENT (WWR)

Curb Reinforcement Steel Notes:

- D19.7 or #4 Bar (Lap Splice Each Longitudinal Wire)
- 1'-0" Min.

WELDED WIRE REINFORCEMENT (WWR)

CURB REINFORCING STEEL NOTES:

- Pre-cured Silicone Sealant (4" wide)
- All reinforcing steel at the open joints shall have a 2" minimum cover.
- Bars 4S may be continuous or spliced at the construction joints.
- Bar splices for Bars 45 shall be a minimum of 1'-9".
- At the option of the Contractor Welded Wire Reinforcement (WWR) may be used in lieu of all Bars 4P and 45. WWR must consist of Defomed wire meeting the requirements of Specification Section 931.

DETAIL "A" - SECTION AT INTERMEDIATE OPEN JOINT

INTERMEDIATE JOINT SEAL NOTE:

At Intermediate Open Joints, seal the lower 6" portion of the open joint with Pre-cured Silicone Sealant in accordance with Specification Section 932. Apply sealant prior to any Class V finish coating and remove all curing compound and loose material from the surface prior to application of bonding agent.

CONVENTIONAL REINFORCING STEEL BENDING DIAGRAMS

BILL OF REINFORCING STEEL

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REVISION NO. SHEET NO. INDEX NO. SHEET NO.

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REV. 1

INDEX NO.

SCHEME 1 - BOTTLE GUARD DETAIL

TYPICAL SECTION THROUGH BOTTOM RAIL

(Post Not Shown for Clarity)

SCHEME 2 - CONCRETE CURB DETAILS

ESTIMATED CONCRETE CURB QUANTITIES (SCHEME 2)

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TYPICAL SECTION THROUGH BOTTOM RAIL

(Post Not Shown for Clarity)

SCHEME 3 - SIDE-MOUNTED SUPPORT BRACKET DETAILS

TYPICAL SECTION

CROSS REFERENCE:

See Sheet 3 for Bridge Railing Notes.
**DETAIL "B" EXPANSION JOINT (FIELD SPlice SImilar)**

**BRIDGE RAILING NOTES:**

APPLICABILITY NOTE: Railing is limited to use on bridges with an expansion joint thermal movements not exceeding 5". Scheme 3 is limited to bridge retrofit applications where additional sidewalk width is required.

Railing Details: For Railing fabrication and installation details and notes see Index No. 850, except that railing shall be fabricated and installed normal to the profile grade longitudinally and vertically transversely, unless otherwise shown in the Contract Plans.

Bottle-Guard (Schemes 1 & 3): L-Shape shall be in accordance with ASTM A36.

Concrete Curb (Scheme 2): Construct concrete curb vertical with the top surface finished level transversely. Concrete class shall be the same as the bridge deck.

Side Mounted Support Bracket (Scheme 3): L-Shape and stiffener plate shall be in accordance with ASTM A36. Welding shall be in accordance with the American Society of Structural Welding Code (Steel) ANSI/AWS D1.1 (current edition). Weld metal shall be E60XX or E70XX. Nondestructive testing of welds is not required. The bracket shall be hot-dip galvanized after fabrication in accordance with Specification Section 962.

Payment: Railing shall be paid per linear foot (Item No. 515-2 Abb) for the steel railing and include the cost of support brackets (Scheme 3). Concrete and reinforcing steel quantities for the concrete curb (Scheme 2), will be included in the bridge deck plan quantity pay items. Payment will be plan quantity measured as the length along the center line of the top rail, and includes rails, posts, pickets, rail splice assembly, base plates, bottle-guard, anchor bolts, nuts, washers, resilient or neoprene pads and all incidental materials and labor required to complete installation of the railing.
**DESCRIPTION:**

All welding shall be in accordance with the American Welding Society Structural Welding Code (Steel) ANSI/AWS D1.1 (current edition). Weld metal shall be E60XX or E70XX. Nondestructive testing of welds shall be per Adams/ABS 011 (current edition). Weld metal shall be E60XX or E70XX. Nondestructive testing of welds is not required.

**COATINGS:**

The steel railing shall be hot-dip galvanized after fabrication in accordance with Section 962 of the Specifications. All nuts, bolts and washers shall be hot-dip galvanized in accordance with Specification Section 962.

**SHOP DRAWINGS:**

Details addressing project specific geometry (line & grade) showing post and expansion joint locations, post and panel type, anchor bolt installation “Case” or lengths, must be submitted by the Contractor to the Engineer for the Engineer’s approval prior to fabrication of the railing. Shop drawings shall be in accordance with the Specifications.

**PAYMENT:**

Payment shall be due when the railing is completed and certified as such by the Engineer. See the Instructions for Design Standards for the design loads, geometry and applicability requirements.

**BASE PLATES AND RAIL CAPS:**

Base Plates and Rail Cap Plates shall be in accordance with ASTM A630 or ASTM A106 Grade 36.

**SHIM PLATES:**

Shim Plates shall be aluminum in accordance with ASTM B209, Alloy 6061 or 6063. Shim plates shall be used for foundation height adjustments greater than 1/8" between 3 posts and localized irregularities greater than 1/8" beneath handrails. In addition, shim plates when necessary to match the contours of the foundation. Shim plates may be used in lieu of crimped flat shim plates shown. Stack shim plates must be bonded together with adhesive bonding material and limited to a maximum total thickness of 1/2", unless longer anchor bolts are provided for the exposed thread length.

**ANCHOR BOLTS:**

Anchor bolts shall be in accordance with ASTM A194 (Grade 36 for 5/8" and Grade 55 for 3/8", 8-4 Bolt Anchor). Headless anchor bolts for Adhesive Anchors are permitted for drilled hole installation. All anchor bolts shall be self-locking. Anchor bolts shall be in accordance with ASTM A36 or ASTM A709 Grade 36. All anchor bolts shall be self-locking nuts. Tack welding of the nut to the anchor bolt may be used in lieu of self-locking nuts. All anchor bolts shall be in accordance with ASTM A563 or ASTM A194. Flat Washers shall be in accordance with ASTM F436 and Plate Washers for long slotted holes only, shall be in accordance with ASTM A36 or ASTM A709 Grade 36. The nuts have been snug tightened, distort the anchor bolt threads to prevent removal of the nuts. The anchor bolts shall be tagged with a powder coating in accordance with the Specifications.

**RESILIENT AND NEOPRENE PADS:**

Resilient and Neoprene pads shall be in accordance with Specification Section 932 except that testing of the finished pads shall not be required. Neoprene pads shall be diameter hardness 60 to 80.

**JOINTS:**

Grind welded joints as necessary to remove burs and weld splatter, additionally remove any sharp edges on rails to prevent injury. Grind all plug welds smooth. Expansion joints shall be spaced at a maximum 40'-0".

Field splices parallel to the expansion joint detail may be approved by the Engineer to facilitate handling, but top rail must be continuous across a minimum of two posts. For intermediate and bottom horizontal rails the welded joints on Sheet 4 may be substituted with alternate joints shown on Sheet 3. All welding shall be in accordance with the American Welding Society Structural Welding Code (Steel) ANSI/AWS D1.1 (current edition). Weld metal shall be E60XX or E70XX. Nondestructive testing of welds is not required.

**NOTES:**

(1) 0.125" wall thickness permitted for rails with post spacings less than 5'-8", except that Post Connection Sleeve must be 1 1/2" NPS (Sch. 40).
RAMP REQUIREMENTS

For slopes greater than 5%:
Max. ramp slope = 8.33%
Max. ramp cross-slope = 2.0%

LANDING REQUIREMENTS

Max. landing slope = 2%
Max. landing cross-slope = 3%

ELEVATION

(Showing Outside Face of Railing with Type "A" Posts)

TYPICAL RAILING DETAILS & RAILINGS ON GRADES 0% TO 5%

(TYPE I - Picket Railing Shown, Other Types Similar)

NOTES:

* Keyed construction joints in Index No. 6011 Gravity Wall are not considered to be expansion joints.
** Contraction joints (Tooled or Saw Cut) in sidewalks do not require a 6" minimum offset.

RAILINGS ON GRADES STEEPER THAN 5%

(TYPE I - Picket Railing Shown, Other Types Similar)
RAILINGS ON STEPS & STAIRS

Steel Handrail required for three or more steps (Handrail and cheekwalls continuous at landings) Handrails = 3/8" NPS (Sch. 40) pipe Equal to one tread length

Steel pedestal/bicycle railing

 cut rail sleeve to match inside face of post or weld rail directly to post

Length of landing 5' Min.

Top of landing

9' Min. thick wall

Varies ~ Approx.

Equal spacing

5'-0" Max. on Steps

Intermediate rail similar

Railing continuation beyond steps or stairs
(Bottom shown, Top similar)

Concrete sidewalk to extend 6' Min. behind railing

Handrail extension

Round over corners ½"

(Typ.)

Rail Termination (End Cap)

Cut rail sleeve to match inside face of post or weld rail directly to post

See "Typical Railing Details", Sheet 2 for post, rail & picket details

See "Typical Railing Details", Sheet 2 for post, rail & picket details

See "Typical Railing Details", Sheet 4 for railing details, Leveling Channel (Typ.)

See Index No. 521 or Contract Plans for Step Details
Intermediate Rail

**DETAIL "A" - RAIL CONNECTIONS**

(Pickets/ Panels and 4-Bolt Anchorage
Not Shown for Clarity)

**NOTES:**

1. Base Plate A (Ramps - Bolts normal) use 1½ ø Holes for Single Anchor Bolts with Flat Washers for slopes ≤ 8.33%.

2. Base Plate B (Stairs - Bolts plumb) use 1½ ø Holes for Single Anchor Bolts with Beveled Plate and Washers for slopes > 8.33% to ≤ 15%; use 1½ x 1½ Slotted Holes with Leveling Channel for slopes > 15%.

* 1½ ø x 1½ Pan Head Stainless Steel (Type 316 or 18-8 Alloy) Set Screws. Screws must be set flush against the outside face of rails & posts and underside of handrails. 1½ ø plug welds may be substituted for the Set Screws. Do not provide Set Screws for Rails at free end of Expansion Joints.

**DETAIL "B" - EXPANSION JOINT (FIELD SPLICE SLIP JOINT SIMILAR)

**VIEW F-F**

INTERMEDIATE OR BOTTOM RAIL - STEEL SLEEVE DETAIL (Bottom Side Shown)

**CROSS REFERENCE:**

For location of Details "B", See Sheet 2.
**TYPE 1 - PICKET INFILL PANEL**

- Picket Spacing of 6\(\frac{1}{2}\) centers is based on a 2\(\frac{1}{8}\) Ø Bar for standard applications.
- When shown in the Contract Plans a 4\(\frac{1}{8}\) picket spacing may be required. If an alternate design is used, maintain a maximum clear opening of 5\(\frac{3}{4}\) for standard installations and 3\(\frac{1}{8}\) for special conditions.

**PICKET NOTES:**

* Chain-Link Fence Fabric shall be continuous along limits of railing.
* Splicing of Chain-Link panels using Tension Bars at 20'-0" minimum increments is permitted.

**SECTION A-A**

**TYPE 2 - CHAIN-LINK (Continuous Infill Panel)**

**NOTE:**

1. See Plans for Infill Panel option required.

**COMPONENT INFORMATION**

<table>
<thead>
<tr>
<th>COMPONENT TYPE</th>
<th>MATERIAL INFORMATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chain-Link Fence Fabric</td>
<td>2&quot; mesh with twisted bottom and knuckled top selvage (coated wire diameter)</td>
</tr>
<tr>
<td>Intermediate Rail</td>
<td>3&quot; Nominal Opening</td>
</tr>
<tr>
<td>Ties</td>
<td>@ 1'-0&quot; center (Post and End Rail)</td>
</tr>
<tr>
<td>Ties</td>
<td>@ 2'-0&quot; center (Intermediate &amp; Bottom Rail)</td>
</tr>
<tr>
<td>Ties</td>
<td>@ 3'-0&quot; center (Bottom Rail)</td>
</tr>
<tr>
<td>Tie Wires</td>
<td>F 626 Zinc-Coated Steel Wire - No. 9 gage with coating to match Chain-Link Fence Fabric.</td>
</tr>
<tr>
<td>Tension Bars</td>
<td>F 626 3/8&quot; (Min. thickness) x 5/8&quot; (Min. width) x 2'-3&quot; (Min. height) Steel Bars</td>
</tr>
<tr>
<td>Miscellaneous Fence Components</td>
<td>F 626 Zinc-Coated Steel</td>
</tr>
</tbody>
</table>
TYPE 3 - SUNSHINE INFILL PANEL

* Arc, Rays and Sun Segment may be formed in a single panel from 1/2" plate (ASTM 36 or A709 - Grade 36) pattern cut with laser or plasma CNC, welded to a 3x1x3/8 Angle Border or the 3x3x3/8 Channel Border shown.

NOTES:
1. See Plans for Infill Panel Option required.
**SECTION A-A**

Seal welding mitered corners is permitted.

**SECTION C-C**

**DETAIL "5A"**

**PANEL/RAIL CONNECTION**

(Top Shown, Bottom Similar)

- Inside Face of Rail
- Channel 3\(x\)3\(x\)1\(x\)\(\frac{1}{4}\) (Typ.)
- Perforated Panel (0.04" Min.)
- #10\(\frac{3}{4}\) Pan Head Screws (18-8 SS) @ 2'-0" sp.
- 3\(\frac{1}{2}\) Filler Strip (Typ.)

**DETAIL "5B"**

**PANEL/END CONNECTION**

(Expansion Joint Shown, Sides Similar)

- Inside Face of Post
- Expansion Joint
- Opening
- peeled Expansion Seal welding mitered corners is permitted
- Perforated Panel (0.04" Min.)
- #10\(\frac{3}{4}\) Pan Head Screws (18-8 SS) @ 1'-0"± sp.
- 3 - #10\(\frac{3}{4}\) Pan Head Screws (18-8 SS) @ 1'-0"± sp.
- Panel Mullion

**REPEATING PATTERN DETAIL**

FOR PERFORATED PANEL

- Perforated Panel (0.04" Min.)
- 3\(\frac{1}{2}\) Filler Strip (Typ.)
- 3\(\frac{1}{2}\) Filler Strip (Typ.)

**NOTES:**

1. See Plans for Infill Panel Type required.
TYPICAL SECTION ON CONCRETE SIDEWALK
(Case I)

TYPICAL SECTION ON RETAINING WALL
(Case II)

TYPICAL SECTION ON STEPS & STAIRS
(Case III)

TYPICAL SECTION FOR 4-BOLT ANCHORAGE
(Case IV)

ANCHOR BOLT TABLE

<table>
<thead>
<tr>
<th>CASE</th>
<th>STRUCTURE TYPE</th>
<th>DIMENSIONS</th>
<th>ANCHOR LENGTH</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>I</td>
<td>Unreinforced Concrete</td>
<td>6&quot; 1-2&quot;</td>
<td>9&quot;</td>
</tr>
<tr>
<td>IIa</td>
<td>Reinforced Concrete</td>
<td>4&quot; 4&quot;</td>
<td>9&quot;</td>
</tr>
<tr>
<td>IIb</td>
<td>Gravity Wall Index No. 6011</td>
<td>4 1/2&quot; 3 1/2&quot;</td>
<td>1-3&quot; 1-2&quot;</td>
</tr>
<tr>
<td>III</td>
<td>Step Checkwall</td>
<td>4 1/2&quot; 4 1/2&quot;</td>
<td>9&quot;</td>
</tr>
<tr>
<td>IV</td>
<td>Varies</td>
<td>9&quot; 5&quot;</td>
<td>5&quot;</td>
</tr>
</tbody>
</table>

* Embedment length "C" may be reduced to 9" for the 42" height railings for Case IIb, when the post spacing does not exceed 5'-0".

** When required; measured from top of sidewalk.
**DETAIL "B" EXPANSION JOINT (FIELD SPLICE SIMILAR)**

- Aluminum Sleeve: 2.50 OD x 0.125 Wall for top rail of rails ½" (Typ.)
- **Round over both ends 1/8" (Typ.)**

**SQUARE RAILS - INTERMEDIATE OR BOTTOM RAIL**

- 1½" Picket Slot (Expansion sides only)
- ⅛" Silt (bottom only)
- Aluminum Sleeve: 1.50 OD x 0.125 Wall for intermediate and bottom rails

**ROUND RAILS - TOP RAIL OR HANDRAIL**

- ½" Ø x ⅝" Pan Head Aluminum (Alloy 7075-T73) or Stainless Steel (Type 316 or 18-8 Alloy) Set Screws along outside face of railing. Set screws must be set flush against the rail surface. A ⅝" Ø plug weld may be substituted for the two set screws at expansion joints.
- **Increase handrail sleeve embedment to 2" for Expansion Joint openings greater than 2".**
- Expansion joint opening shall match the clear opening in the deck joint but not greater than 3".

**BRIDGE RAILING NOTES:**

**APPLICATIONS NOTE:** Railing is limited to use on bridges with an expansion joint thermal movements not exceeding 3". Scheme 3 is limited to bridge retrofit applications where additional sidewalk width is required.

**RAILING DETAILS:** For Railing fabrication and installation details and notes see Index No. 860, except that railing shall be fabricated and installed normal to the Profile Grade longitudinally and vertical transversely, unless otherwise shown in the Contract Plans.

**BOTTLE-GUARD (Schemes 1 & 3):** L-Shape shall be in accordance with ASTM B209, Alloy 6063-T5 or 6061-T6.

**CONCRETE CURB (Scheme 2):** Construct concrete curb vertical with the top surface finished level transversely. Concrete class shall be the same as the bridge deck.

**SIDE-MOUNTED SUPPORT BRACKET (Scheme 3):** L-Shape and Stiffener Plate shall be in accordance with ASTM B209, Alloy 6061-T6. Welding shall be in accordance with the American Society of Structural Welding Code (Aluminum) ANSI/AWS D1.2 (current edition). Filler metal shall be either ER4043, ER5183, ER5356 or ER5556. Nondestructive testing of welds is not required.

**PAYMENT:** Railing shall be paid per linear foot (Item No. 515-2-abb) for the aluminum railing and include the cost of support brackets (Scheme 3). Concrete and reinforcing steel quantities for the concrete curb (Scheme 2), will be included in the bridge deck plan quantity pay items. Payment will be plan quantity measured as the length along the center line of the top rail, and includes rails, posts, pickets, rail splice assembly, base plates, bottle-guards, anchor bolts, nuts, washers, resilient or neoprene pads and all incidental materials and labor required to complete installation of the railing.
**TABLE 1 - RAILING MEMBERS**

<table>
<thead>
<tr>
<th>TABLE 1 NOTES:</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Alloy 6061-T6 or 6063-T52 &amp; T6 may be substituted for Alloy 6063-T5.</td>
</tr>
<tr>
<td>(2) 0.125&quot; wall thickness permitted for rails with post spacings less than 3'-6&quot;.</td>
</tr>
<tr>
<td>(3) 1&quot; NPS (Sch. 40) non-slit rail sleeves may be substituted when welded connection detail &quot;K&quot; is utilized.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MEMBER</th>
<th>ALLOY</th>
<th>DESIGNATION</th>
<th>OUTSIDE DIMENSION</th>
<th>WALL THICKNESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posts (Type &quot;A&quot; &amp; &quot;B&quot;)</td>
<td>6061-T6</td>
<td>RT 2x2x.250</td>
<td>2.0&quot; x 2.0&quot;</td>
<td>0.250&quot;</td>
</tr>
<tr>
<td>Posts (Type &quot;C&quot;)</td>
<td>6063-T5</td>
<td>Extrusion 1½x1½x.125</td>
<td>1.50&quot; x 1.50&quot;</td>
<td>0.125&quot;</td>
</tr>
<tr>
<td>Top Rail Joint/Splice Sleeves</td>
<td>6063-T5</td>
<td>1.50 OD x 0.125 Wall</td>
<td>1.50&quot; x 0.125&quot;</td>
<td>0.250&quot;</td>
</tr>
<tr>
<td>Handrail Joint/Splice Sleeves</td>
<td>6061-T6</td>
<td>1&quot; NPS (Sch. 40)</td>
<td>1.00&quot;</td>
<td>0.125&quot;</td>
</tr>
<tr>
<td>Pickets (Type 3 &amp; 5)</td>
<td>6061-T6</td>
<td>3/4&quot; Round Bar</td>
<td>0.750&quot;</td>
<td>N/A</td>
</tr>
</tbody>
</table>

**NOTES**

- Design Loads, Geometry and Applicability:
  - See the Instructions for Design Standards for the design loads, geometry and applicability requirements.
- General:
  - Adequate foundation support shall be provided for anchorage and stability against overturning (See Sheet B1. See Index No. 851 for special requirements and modifications for use on bridges. The railing shown on these drawings requires a handrail for ramps steeper than a 5% grade to conform with the requirements of the Americans with Disabilities Act (ADA).)
- Rails, Panels and Posts:
  - Structural Extrusions, Tubing, Pipe and Bar shall be in accordance with Table 1 and ASTM B221 or ASTM B429. Top, bottom and intermediate rail corner bends with maximum 4'-0" post spacing, may be Alloy 6063-T6. Forstpered panels (Type 5) shall be Alloy 6003-H14. Posts shall be fabricated and installed plumb, ± 1" tolerance when measured at 3'-6" above the foundation. Pickets and vertical panel elements shall be fabricated parallel to the posts, except that Type 7, 3 & 5 panel infills may be fabricated parallel to the longitudinal grade. Corners and changes in tangential longitudinal alignment shall be made continuous with a 3" bend radius or terminate at adjoining sections with mitered end sections when handrails are not required. For changes in tangential longitudinal alignment greater than 45°, posts shall be positioned at a maximum distance of 7'-0" from either side of the corner. For curved longitudinal alignments the top and bottom rails and handrails shall be shop bent to match the alignment radius.
- Base Plates and Rail Caps:
  - Base plates and post cap plates shall be in accordance with ASTM B299, Alloy 6061-T6.
- Shim Plates:
  - Shim plates shall be used in accordance with ASTM B299, Alloy 6061 or 6063. Shim plates shall be used for foundation height adjustments greater than ±0.25" between 3 posts and localized irregularities greater than ±0.25" beneath base plates. Field trim shim plates necessary to match the contours of the foundation. Beveled shim plates may be used in lieu of trimmed flat shim plates shown. Beveled shim plates shall be bonded together with adhesive bonding material and limited to a maximum total thickness of 0.25", unless longer anchor bolts are provided for the exposed thread length.
- Anchor Bolts:
  - Anchor bolts shall be in accordance with ASTM F1554 (Grade 36 for 1¼" Ø and Grade 55 for 1¾" Ø Bolt Anchorage). Headless anchor bolts for Adhesive Anchors shall be threaded full length. Cutting of reinforcing steel is permitted for drilled hole installations. Expansion anchors are not permitted. All anchor bolts shall have single self-locking hex nuts. Tack welding the nut to the anchor bolt may be used in lieu of self-locking nuts. All nuts shall be in accordance with ASTM A563 or ASTM A194. Flat Washers shall be in accordance with ASTM F436 Plate Washers (for long slotted holes only), shall be in accordance with ASTM A563 or ASTM A709 Grade 36. After the nuts have been snug tightened, distort the anchor bolt threads to prevent removal of the nuts. Distorted threads and tack welds shall be coated with a galvanizing compound in accordance with the Specifications.
- Resilient and Neoprene Pads:
  - Resilient and Neoprene pads shall be in accordance with Specification Section 932 except that testing of the finished pads shall not be required. Neoprene pads shall be durometer hardness 60 to 80.
- Joints:
  - Grind welded joints as necessary to remove burrs and weld splatter, additionally remove any sharp edges on rails to prevent injury. Grind all plug welds smooth. Expansion joints shall be spaced at a maximum 40'-0". Field splices similar to the expansion joint detail may be approved by the Engineer to facilitate handling, but top rail must be continuous across the intersection of two posts. For intermediate and bottom horizontal rails the screwed joints shown on Sheet 4 may be substituted with alternate joint shown on Sheet 4 Detail "K" for Post Type "K" & "B".
- Welding:
  - All welding shall be in accordance with the American Welding Society Structural Welding Code (Aluminum) ANSI/AWS D1.1 (current edition). Filler metal shall be either ER5183, ER5356 or ER5556. Nondestructive testing of welds is not required.
  - All welding shall be in accordance with the American Welding Society Structural Welding Code (Aluminum) ANSI/AWS D1.1 (current edition). Filler metal shall be either ER5183, ER5356 or ER5556. Nondestructive testing of welds is not required.
  - Filler metal for plug welds and bond splices may be ER4043.
- Coatings:
  - The aluminum railing shall be mill finish unless otherwise noted in the Contract Documents. All nuts, bolts and washers shall be galvanized in accordance with Specification Section 962.
- Shop Drawings:
  - Details addressing project specific geometry (line & grade) showing post and expansion joint locations, post and panel type, anchor bolt installation "Case" or lengths, must be submitted by the Contractor for the Engineer's approval prior to fabrication of the railing. Shop drawings shall be in accordance with the Specifications.
- Payment:
  - Payment includes rails, posts, pickets, panels, rail splice assembly, base plates, anchor bolts, nuts, washers, resilient or neoprene pads and all incidental materials and labor required to complete installation of the railing.

**INDEX**

- SHEET NO. 862
- OF 9

**DESIGN STANDARDS**

**ALUMINUM PEDESTRIAN/BICYCLE RAILING**

**LAST REVISION**

- 01/01/16

**DESCRIPTION:**

- FY 2016-17
Handrail required for ramps (Handrail continuous at landings between runs)  
Handrail = 1½” NPS Sch. 40  

42” Handrail/Bicycle Railing (PBR)  

TYPICAL RAILING DETAILS & RAILINGS ON GRADES 0% TO 5%  
(Type 1 - Picket Railing Shown, Other Types Similar)

ELEVATION  
(Showing Outside Face of Railing with Type "A" Posts)  

NOTES:  
* Keyed construction joints in Index No. 6011 Gravity Wall are not considered to be expansion joints.  ** Contraction joints (Tooled or Saw Cut) in sidewalks do not require a 6” minimum offset.

EXPANDED ELEVATION AT CORNERS  
TIME LAPE: NON-CONTINUOUS RAILING AT CORNERS

DETAIL FOR NON-CONTINUOUS RAILING AT CORNERS

RAILINGS ON GRADES STEEPER THAN 5%  
(Type 1 - Picket Railing Shown, Other Types Similar)  

ELEVATION  
(Showing Inside Face of Railing with Type "A" Posts)  

NOTES:

rail expansion joints to be located in panels above structure expansion joints *(35'-0" maximum spacing).

RAIL REQUIREMENTS  
For slopes greater than 5%:  
Max. ramp slope = 8.33%  
Max. ramp cross-slope = 2.0%

LANDING REQUIREMENTS  
Max. landing slope = 2%  
Max. landing cross slope = 3%
RAILINGS ON STEPS & STAIRS

ALUMINUM PEDESTRIAN/BICYCLE RAILING

INDEX NO. 521 or Contract Plans for Step Details

ELEVATION
(At-Grade Steps shown, Elevated Stairs similar)
BASE PLATE DETAILS FOR TYPE "C" POST

(Screws Not Shown For Clarity)

PLAN

SECTION "I-1"

SECTION "I-2"

VIEW "I"

TOP PLATE DETAILS FOR TYPE "C" POST

(Screws Not Shown For Clarity)

† See Sheet 4 for Notes.
†† See Sheet 4 for Notes.
††† Length varies for beveled posts on grades. Holes must be drilled plumb to align with screw slot.

ALUMINUM PEDESTRIAN/BICYCLE RAILING
TYPE 1 - PICKET INFILL PANEL

PICKET NOTES:
* Picket Spacing of 6\(\frac{3}{4}\)" centers is based on a 2" Ø Bar for standard applications.
When shown in the Contract Plans a 4\(\frac{3}{4}\)" picket spacing may be required. If an alternate design is used, maintain a maximum clear opening of 5\(\frac{3}{4}\)" for standard installations and 3\(\frac{3}{4}\)" for special conditions.

SECTION A-A

TIES @ 1'-0" center (Post and End Rail)
Ties @ 2'-0" center (Intermediate & Bottom Rail)
Chain-Link Fence Fabric tied to inside face of railing

SECTION A-A

NOTES:
1. See Plans for Infill Panel option required.

TYPE 2 - CHAIN-LINK (Continuous Infill Panel)

CHAIN-LINK PANEL NOTE:
Chain-Link Fence Fabric shall be continuous along limits of railing. Splicing of Chain-Link panels using Tension Bars at 20'-0" minimum increments is permitted.

TABLE 2 - CHAIN-LINK PANEL COMPONENT MATERIALS

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>ASTM</th>
<th>COMPONENT INFORMATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chain-Link Fence Fabric (2&quot; mesh with twisted bottom and knuckled top selvage)</td>
<td>392</td>
<td>Zinc-Coated Steel - No. 9 gage (coated wire diameter), Class 2 Coating</td>
</tr>
<tr>
<td></td>
<td>491</td>
<td>Aluminum-Coated Steel - No. 9 gage (coated wire diameter)</td>
</tr>
<tr>
<td>Polyvinyl Chloride (PVC) Coated Steel - No. 9 gage Zinc-Coated Wire (metallic-coated core wire diameter) - See Plans for specified color of PVC.</td>
<td>668</td>
<td></td>
</tr>
<tr>
<td>Tie Wires</td>
<td>626</td>
<td>Zinc-Coated Steel Wire - No. 9 gage with coating to match Chain-Link Fence Fabric.</td>
</tr>
<tr>
<td>Tension Bars</td>
<td>626</td>
<td>1(\frac{5}{8})&quot; (min. thickness) x 2(\frac{1}{2}&quot; (min. width) x 2'-3&quot; (min. length) Steel Bars</td>
</tr>
<tr>
<td>Miscellaneous Fence Components</td>
<td>626</td>
<td>Zinc-Coated Steel</td>
</tr>
</tbody>
</table>

F 626  1\(\frac{5}{8}\)" (min. thickness) x 2\(\frac{1}{2}\" (min. width) x 2'-3" (min. length) Steel Bars

ALUMINUM PEDESTRIAN/BICYCLE RAILING

INDEX NO. 862  SHEET NO. 6 of 9

DESIGN STANDARDS

FY 2016-17

LAST REVISION 07/01/15

DESCRIPTION: ALUMINUM PEDESTRIAN/BICYCLE RAILING

REVIEWS: 07/01/15
TYPE 3 - SUNSHINE INFILL PANEL

* Arc, Rays and Sun Segment may be formed in a single panel from 5/8" plate (ASTM B209 Alloy 6061-T6 or T651) pattern cut with laser or plasma CNC, welded to a 1x1 1/2" Angle Border or the 5/8x5/8 Channel Border shown.

NOTES:
1. See Plans for Infill Panel Option required.
TYPE 5 - PERFORATED INFILL PANEL

Perforated Panel (0.04" Min.)
Panel Mullion

3'-0" Max. (Panel Width)

REPEATING PATTERN DETAIL FOR PERFORATED PANEL

DETAIL "5A"
PANEL/RAIL CONNECTION (Top Shown, Bottom Similar)

DETAIL "5B"
PANEL END CONNECTION (Expansion Joint Shown, Sides Similar)

Seal welding mitered corners is permitted

Inside Face of Rail

#10 x \( \frac{1}{2} \)" Pan Head Screws (18-8 SS) @ 2'-0" sp. (Typ.)

Panel Mullion

42" Special Height Bicycle Railing

ALUMINUM PEDESTRIAN/BICYCLE RAILING

DESIGN STANDARDS

FY 2016-17

INDEX NO. 862

SHEET NO. 8 of 9
**DESCRIPTION:**

**REVISION NO.**

**REVISION LAST OF DESIGN STANDARDS 2016-17**

---

**TYPICAL SECTION ON CONCRETE SIDEWALK**

- Case I

---

**TYPICAL SECTION ON RETAINING WALL**

- Case II

---

**ANCHOR BOLT TABLE**

<table>
<thead>
<tr>
<th>CASE TYPE</th>
<th>STRUCTURE TYPE</th>
<th>DIMENSIONS</th>
<th>ANCHOR LENGTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Unreinforced Concrete</td>
<td>6&quot;</td>
<td>2&quot;</td>
</tr>
<tr>
<td>IIa</td>
<td>Reinforced Concrete</td>
<td>4&quot;</td>
<td>4&quot;</td>
</tr>
<tr>
<td>IIb</td>
<td>Gravity Wall</td>
<td>4½&quot;</td>
<td>4½&quot;</td>
</tr>
<tr>
<td>III</td>
<td>Step Cheekwall</td>
<td>4½&quot;</td>
<td>4½&quot;</td>
</tr>
<tr>
<td>IV</td>
<td>Varies</td>
<td>5&quot;</td>
<td>5&quot;</td>
</tr>
</tbody>
</table>

*Embedment length "C" may be reduced to 9" for the 42" height railings for Case IIa, when the post spacing does not exceed 5'-0".*

**When required, measured from top of sidewalk (Typ.)**

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**ALUMINUM PEDESTRIAN/BICYCLE RAILING**

**INDEX NO.**

**SHEET NO.** 9 of 9
PIECE RAILING & POSTS:
Structural Tube, Pipe and Bar shall be in accordance with ASTM B221 or ASTM B429. Alloy 6061-T6, 2024-T3, 7075-T6, and 6301-T6, and/or equivalent. End Rail 90° bends and corner bends with maximum 4'-0" post spacing, may be alloy 6063-T6. Posts and End Rails shall be fabricated and installed using a 1" tolerance when measured at 7'-0" above the finished grade. Corners and changes in tangential longitudinal alignment, may be made continuous with a 90° bend radius or terminated at adjoining sections with a standard end cap when handrails are not required. For changes in tangential longitudinal alignment greater than 45°, posts shall be positioned at a maximum distance of 2'-0" each side of the corner and shall not be located at the corner apex.
For curved longitudinal alignments the top and bottom rails and handrails shall be shop bent to match the alignment radius.

### Railing Member Dimensions Table

<table>
<thead>
<tr>
<th>MEMBER</th>
<th>DESIGNATION</th>
<th>OUTSIDE DIMENSIONS</th>
<th>WALL THICKNESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posts</td>
<td>2&quot; NPS (Sch. 40)</td>
<td>2.375&quot;</td>
<td>0.154&quot;</td>
</tr>
<tr>
<td>Rails</td>
<td>2&quot; NPS (Sch. 40)</td>
<td>2.375&quot;</td>
<td>0.154&quot;</td>
</tr>
<tr>
<td>Rail Joint/Splice Sleeves</td>
<td>1½&quot; NPS (Sch. 40)</td>
<td>1.900&quot;</td>
<td>0.145&quot;</td>
</tr>
<tr>
<td>Handrail Joint/Splice Sleeves</td>
<td>1½&quot; NPS (Sch. 40)</td>
<td>1.900&quot;</td>
<td>0.145&quot;</td>
</tr>
<tr>
<td>Handrail Support Bar</td>
<td>1&quot; Ø Round Bar</td>
<td>1.000&quot;</td>
<td>N/A</td>
</tr>
</tbody>
</table>

**BASE PLATES:**
Base Plates shall be in accordance with ASTM B209, Alloy 6061-T6.

**SHIM PLATES:**
Shim plates shall be aluminum in accordance with ASTM B209. Alloy 6061 or 6063. Shim plates shall be used for foundation height adjustments greater than ½" between 3 posts and localized irregularities greater than ½" beneath base plates. Field trim shim plates when necessary to match the contours of the foundation. Beveled shim plates may be used in lieu of trimmed flat shim plates shown. Stacked shim plates must be bonded together with adhesive bonding material and limited to a maximum total thickness of ½", unless longer anchor bolts are provided for the exposed thread length.

**COATINGS:**
The aluminum railing shall be mill finish unless otherwise noted in the Contract Documents. All nuts, bolts and washers shall be hot-dip galvanized in accordance with Section 962 of the Specifications.

**ANCHOR BOLTS:**
Anchor bolts shall be in accordance with ASTM F1554 Grade 36. Headless anchor bolts for Adhesive Anchor shall be threaded full length. Cutting of reinforcing steel is permitted for drilled hole installation. All anchor bolts shall have single self-locking hex nuts. Tack welding of the nut to the anchor bolt may be used in lieu of anti-rotation rings. All nuts shall be in accordance with ASTM A563 or ASTM A194. Flat Washers shall be in accordance with ASTM F436 and Plate Washers (for long slotted holes only), shall be in accordance with ASTM A564 or ASTM A570 Grade 36. After the nuts have been snug tightened, the anchor bolt threads shall be distorted to prevent removal of the nuts. Distorted threads and lock washers shall be coated with a galvanizing compound in accordance with the Specifications.

**RESILIENT AND NEOPRENE PADS:**
Resilient and Neoprene pads shall be in accordance with Specification Section 922, except that testing of the finished pads shall not be required. Neoprene pads shall be durometer hardness 60 or 70.

**JOINTS:**
All fixed joints are to be welded all around and ground smooth. Expansion joints shall be spaced at a maximum of 30'-0". Field spacing similar to the expansion joint details may be approved by the Engineer to facilitate shipping and handling, but rails must be continuous across a minimum of two parking bays. Only use the Continuity Field Splice (Detail "E") to make the railing continuous for unforeseen field adjustments.

**WELDING:**
All welding shall be in accordance with the American Welding Society Structural Welding Code (Aluminum) AWS/ESW S1.1.2 (current edition). Filler metal shall be either ER5183, ER5356 or ER5556. Nondestructive Testing of welds is not required.

**SHOP DRAWINGS:**
Details addressing project specific geometry (line & grade) showing post and expansion joint locations must be submitted by the Contractor for the Engineer’s approval prior to fabrication of the railing. Shop drawings shall be in accordance with the Specifications.

**PAYMENT:**
Guiderail shall be paid for under the contract unit price for Pipe Guiderail (Aluminum). If (Item No. 513-1-21). Payment for the Guiderail will be plan quantity measured as the length along the center line of the top rail, and includes rails, posts, rail splice assembly, base plates, anchor bolts, nuts, washers, resilient or neoprene pads and all incidental materials and labor required to complete installation of the Guiderail.
ELEVATION

**TYPICAL RAILING DETAILS & RAILINGS ON GRADES 0% TO 5%**

- **Post Spacing**
  - 1'-6" (Typ.)
  - 6'-0" (Max.) - Equal Panels

- **Rail - 2" NPS Sch. 40 (Typ.)**
  - See Details "C" Sheet 4
  - See "Typical Railing Details" for post & rail details

- **Rail Expansion Joint (Typ.)**
  - See Details "D" & Sheet 4
  - Min. from free end of concrete and expansion joints (Typ.)

- **Rail Expansion Joint (Typ.)**
  - Varies (4" Min., 1'-6" Max.) (Typ.)
  - For post & rail details
  - See "Typical Railing Details"

- **Handrail - 1½" NPS Sch. 40 (Typ.)**
  - Min. 1'-6" (Typ.)

- **Intermediate Landing**
  - 5'-0" Min.

- **Ramp Requirements**
  - Max. landing cross-slope ≤ 2.0%
  - Max. landing slope ≤ 2.0%

**RAMP REQUIREMENTS**

**LANDING REQUIREMENTS**

**RAILINGS ON GRADES STEEPER THAN 5% TO 8.33%**

- **Interim Landing**
  - 2'-0" Max.

- **Intermediate Landing**
  - 4'-0" Min.

- **Top Landing**
  - 5'-0" Min.

- **Ramp**
  - 3'-0" Max. for slopes ≥ 6.25%
  - ≥ 0'-0" Max. for slopes ≥ 6.25%

**NOTES:**

- NPS = Nominal Pipe Size
- Wall are not considered to be expansion joints.
- * Keyed construction joints in Index No 6011 Gravity Structures Expansion Joints

**REFERENCES:**

- For Details "C", "D" and "E", see Sheet 4.
GUIDERAIL ON STEPS & STAIRS

FY 2016-17
DESIGN STANDARDS

ALUMINUM PIPE GUIDERAIL

INDEX NO. 870
SHEET NO. 3 of 5

DESCRIPTION:

REVISION

LAST REVISION
07/01/15

GUIDERAIL ON STEPS & STAIRS

RAILING CONTINUATION BEYOND STEPS
(Bottom shown, Top similar)

Concrete sidewalk to extend 6" min. behind Handrail

See 'Typical Railing Details', Sheet 2 for post & rail details

Handrail ~ 1½" NPS (Sch. 40)
Continuous at landings
(Handrail and cheekwalls for three or more steps Aluminum Handrail required)

Handrail termination
See Detail "A" (Typ.)

Handrail Continuation
Varies = Equal spacing
6'-0" Max. on Steps

Length of Landing (At-Grade Steps)

ELEVATION
(At-Grade Steps)

Handrail Termination, See Detail "A" (Typ.)

ALTERNATE END TREATMENT

DETAIL "A" - PLAN VIEW
HANDRAIL TERMINATION

See 'Typical Railing Details', Sheet 2 for post & rail details

Handrail

Handrail Termination
See Detail "A" (Typ.)

Handrail Continuation
Varies = Equal spacing
6'-0" Max. on Steps

Length of Landing (At-Grade Steps)

ELEVATION
(At-Grade Steps)

Handrail Termination, See Detail "A" (Typ.)

ALTERNATE END TREATMENT

GUIDERAIL ON STEPS & STAIRS

FY 2016-17
DESIGN STANDARDS

ALUMINUM PIPE GUIDERAIL

INDEX NO. 870
SHEET NO. 3 of 5

DESCRIPTION:

REVISION

LAST REVISION
07/01/15

GUIDERAIL ON STEPS & STAIRS

RAILING CONTINUATION BEYOND STEPS
(Bottom shown, Top similar)

Concrete sidewalk to extend 6" min. behind Handrail

See 'Typical Railing Details', Sheet 2 for post & rail details

Handrail ~ 1½" NPS (Sch. 40)
Continuous at landings
(Handrail and cheekwalls for three or more steps Aluminum Handrail required)

Handrail termination
See Detail "A" (Typ.)

Handrail Continuation
Varies = Equal spacing
6'-0" Max. on Steps

Length of Landing (At-Grade Steps)

ELEVATION
(At-Grade Steps)

Handrail Termination, See Detail "A" (Typ.)

ALTERNATE END TREATMENT

DETAIL "A" - PLAN VIEW
HANDRAIL TERMINATION

See 'Typical Railing Details', Sheet 2 for post & rail details

Handrail

Handrail Termination
See Detail "A" (Typ.)

Handrail Continuation
Varies = Equal spacing
6'-0" Max. on Steps

Length of Landing (At-Grade Steps)

ELEVATION
(At-Grade Steps)

Handrail Termination, See Detail "A" (Typ.)

ALTERNATE END TREATMENT
DETAIL "C" - RAIL CONNECTIONS

(Handrail and 4~Bolt Anchorage Not Shown)

DETAIL "D" - EXPANSION JOINT
(FIELD SPlice SLIP JOINT SIMILAR)

DETAIL "E" - CONTINUITY
FIELD SPlice

ALUMINUM PIPE GUIDERAIL
**REVISION OF DESIGN STANDARDS FY 2016-17**

**ALUMINUM PIPE GUIDERAIL**

**DESCRIPTION:**

**REVISION NO.**

**SHEET NO.**

**INDEX NO.**

**07/01/15**

**5 of 5**

**870**

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**TYPICAL SECTION ON CONCRETE SIDEWALK**

**TYPICAL SECTION ON GRAVITY WALL**

(Other Retaining Walls Similar)

**TYPICAL SECTION ON STEPS & STAIRS**

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**DETAL *F* (OPTIONAL SHIMMING DETAIL FOR CROSS SLOPE CORRECTION)**

(Used in lieu of Beveled Shim Plates)

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**SIDEWALK ANCHORAGE DETAIL OPTION 1**

**SIDEWALK ANCHORAGE DETAIL OPTION 2 & 3**

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**NOTES:**

1. **2 ~ 3/8" Ø x 8" or 4 ~ 3/8" Ø x 6" Steel Anchors:**
   - Galvanized Steel Bolts (As Shown) (C-I-P); Galvanized U-Bolts Permitted (C-I-P); Galvanized Adhesive Anchors Permitted (***);
   - Expansion Anchors Not Permitted.

2. Adhesive anchors shall be fully threaded headed anchor bolts set in drilled holes (manufacturer recommended diameter) with expansion bolts, when required. The hole shall be set in accordance with Specification Section 926. The minimum embedment is 6" for 2-Bolt Anchorage or 4" for 4-Bolt Anchorage.

3. **3 1/2" Ø Core Drilled Hole (3/4"); clear hole in accordance with Specification Section 416**

4. **6" Foundation Embedment permitted (Option 3)**
### RAILING MEMBER DIMENSIONS TABLE

<table>
<thead>
<tr>
<th>MEMBER DESIGNATION</th>
<th>OUTSIDE DIMENSION</th>
<th>WALL THICKNESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posts 2” NPS (Sch. 40)</td>
<td>2.375”</td>
<td>0.154”</td>
</tr>
<tr>
<td>Rails 2” NPS (Sch. 40)</td>
<td>2.375”</td>
<td>0.154”</td>
</tr>
<tr>
<td>Rail Joint/Splice Sleeves</td>
<td>1.900”</td>
<td>0.145”</td>
</tr>
<tr>
<td>Handrail Joint/Splice Sleeves</td>
<td>1.500”</td>
<td>0.125”</td>
</tr>
<tr>
<td>Handrail Joints</td>
<td>1.900”</td>
<td>0.145”</td>
</tr>
<tr>
<td>Handrail Support Bar</td>
<td>1.000”</td>
<td>N/A</td>
</tr>
</tbody>
</table>

### BASE PLATES
- Base Plates shall be in accordance with ASTM A36 or ASTM A709 Grade 36.

### SHIM PLATES
- Shim Plates shall be aluminum in accordance with ASTM B506, Alloy 6061 or 6063. Shim plates shall be used for foundation height adjustments greater than \( \frac{h}{3} \) between 3 posts and localized irregularities greater than \( \frac{h}{5} \) beneath base plates. Fold or trim shim plates when necessary to match the contours of the foundation (See Sheet 5 for additional details). Stacked shim plates may be used in lieu of trimmed flat shim plates shown. Stacked shim plates must be bedded together with adhesive bonding material and limited to a maximum total thickness of 5”, unless longer anchor bolts are provided for the exposed thread length.

### WELDING
- All welding shall be in accordance with the American Welding Society Structural Welding Code (Steel) AWS D1.1 (current edition). Weld metal shall be E60XX or E70XX. Nondestructive testing of welds is not required.

### ANCHOR BOLTS
- Anchor bolts shall be in accordance with ASTM F1554 Grade 36. Headless anchor bolts for Adhesive Anchor Bolt Attachment shall be threaded full length. All anchor bolts shall have single self-locking hex nuts. Tack welding of the nut to the anchor bolt may be used in lieu of self-locking nuts. All anchor bolts shall be in accordance with ASTM A36 or ASTM A194. Flat Washers shall be in accordance with ASTM F436 and Plate Washers (for long slotted holes only), shall be in accordance with ASTM A36 or ASTM A709 Grade 36. After the nuts have been snug tightened, distort the anchor bolt threads or disfigure the top of stud to prevent removal of the nuts. Distorted threads and tack welds shall be coated with a galingizing compound in accordance with the Specifications.

### RESILIENT AND NEOPRENE PADS
- Resilient and Neoprene pads shall be in accordance with Specification Section 932, except that testing of the finished pads shall not be required. Neoprene pads shall be durometer hardness 60 or 70.

### JOINTS
- All fixed joints are to be welded all around and plug welds shall be used for foundation height adjustments greater than \( \frac{h}{3} \) between 3 posts and localized irregularities greater than \( \frac{h}{5} \) beneath base plates. All welds shall be coated with a galingizing compound in accordance with Section 962 of the Specifications.

### SHOP DRAWINGS
- Details addressing project specific geometry (line & grade) showing post and expansion joint locations must be submitted by the Contractor for the Engineer's approval prior to fabrication of the railing. Shop drawings shall be in accordance with the Specifications.
**TYPICAL RAILING DETAILS & RAILINGS ON GRADES 0% TO 5%**

- **Post Spacing**: 6'-0" (Max.) – Equal Panels
- **Post**: 1'-6" (Typ.)
- **Rail Expansion Joint (Typ.)**: See Detail "D" Sheet 4
- **Rail ~ 2" NPS**: See Detail "C" Sheet 4
- **Handrail ~ 1½" NPS**: Sch. 40 (Typ.)
- **Handrail**: 1½" NPS Sch. 40 (Typ.)

**ELEVATION**

**TYPICAL RAILING DETAILS & RAILINGS ON GRADES 0% TO 5%**

- **Post Spacing**: 6'-0" (Max.) ~ Equal Panels
- **Post**: 1'-6" (Typ.)
- **Rail Expansion Joint (Typ.)**: See Detail "D" Sheet 4
- **Rail ~ 2" NPS**: See Detail "C" Sheet 4
- **Handrail ~ 1½" NPS**: Sch. 40 (Typ.)
- **Handrail**: 1½" NPS Sch. 40 (Typ.)

**RAMP REQUIREMENTS**

- **Ramp**: 30'-0" Max. for Slopes ≤ 6.25%
- **Ramp**: 40'-0" Max. for Slopes > 6.25%
- **Intermediate Landing**: 5'-0" Min.
- **Bottom Landing**: 6'-0" Min.
- **Top Landing**: 2'-6" Max.

**LANDING REQUIREMENTS**

- **Landing Requirements**: 5'-0" Min.
- **Max. ramp slope = 8.33%**
- **Max. landing cross-slope = 2%**

**RAILINGS ON GRADES STEEPER THAN 5% TO 8.33%**

**ELEVATION**

- **Top of Sidewalk or Bikeway**: Ground Line
- **Minimum from free end of concrete and expansion joints (Typ.)**: 1'-6" Max.
- **Post**: For post & rail details
- **See "Typical Railing Details"**
- **See Plans for continuation or termination limits of railing**

**NOTES:**

- **NPS = Nominal Pipe Size**
- **STRUCTURES EXPANSION JOINTS NOTE:**
  - Keyed construction joints in Index No. 6011 Gravity Wall are not considered to be expansion joints.

**CROSS REFERENCE:**

For Details "C", "D" and "E", see Sheet 4.
RAILING CONTINUATION BEYOND STEPS
(Bottom shown, Top similar)

Steel Handrail required for three or more steps (Handrail and cheekwalls continuous at landings) Handrail – 1½" NPS (Sch. 40)

ELEVATION
(At-Grade Steps)

GUIDERAIL ON STEPS & STAIRS

STEEL PIPE GUIDERAIL

INDEX NO. 880
}

DESCRIPTION:
FY 2016-17
DESIGN STANDARDS

ALTERNATE END TREATMENT
**TYPICAL SECTION ON CONCRETE SIDEWALK**

- 3-1/8" Anchor Bolts (***), with self-locking hex nuts & washers
- Full size Shim Plates when required for height adjustment

**TYPICAL SECTION ON GRAVITY WALL**

- 3/16" Min. Beveled
- Build-up (Typ)
- Epoxy Mortar (Type E) in accordance with Specification Section 926

**OPTIONAL SIDEWALK ANCHORAGE DETAIL**

- 11/2" Min. Beveled
- Build-up (Typ)
- Epoxy Mortar (Type E) in accordance with Specification Section 926

**SIDEWALK ANCHORAGE DETAIL**

- 11/2" Min. Beveled
- Build-up (Typ)
- Epoxy Mortar (Type E) in accordance with Specification Section 926

**NOTES:**

- **2** - 11/2" Ø x 8" or 4 - 11/2" Ø x 6" Steel Anchors: Galvanized Steel Bolts (As Shown) (C-I-P); Galvanized U-Bolts Permitted (C-I-P); Galvanized Adhesive Anchors Permitted (***): Expansion Anchors Not Permitted.

- *** Adhesive anchors shall be fully threaded headers anchor bolts
- set in drilled holes (manufacturer recommended diameter) with an Adhesive Bonding Material System in accordance with Specification Section 827 and installed in accordance with manufacturer's instructions.

- **2**-Bolt Anchorage or **4** for 4-Bolt Anchorage.